AGRICULTURAL *Chemicals*

In this issue

The Ark-Mo Process

Bayer 17147 for Cotton

Fertilizer Granulation

Fungicides & Miller Law

Sulfur . . . Up to Date

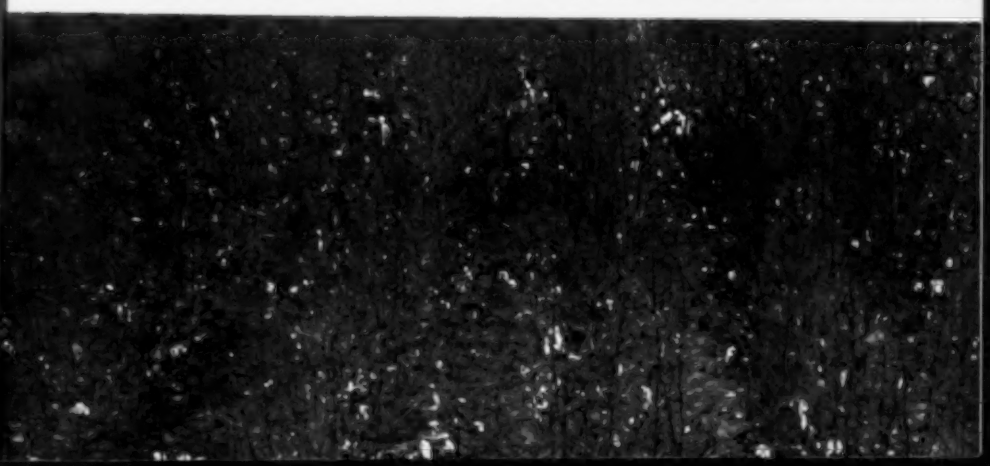
N. C. Pesticide School

Uramon in Granulation

Natural Predators

Entomology's Future

Phillips' Fertilizer Plant



February, 1956

Quality* INSECTICIDES

Only POWCO BRAND can give you these positive assurances of consistent top laboratory-controlled *quality* in every insecticide shipment.

- **FINENESS**—ALL POWCO BRAND insecticide powders are reduced to micron-size particles by high powered precision equipment. This insures the dusting qualities you need for maximum insect control.
- **EMULSIFICATION**—All POWCO BRAND insecticide emulsion concentrates are designed to produce the most desired emulsions in your particular type of water.
- **WETTABILITY-SUSPENSIBILITY**—All POWCO BRAND wettable powders are highly suspensible and wet quickly for ease in application and maximum effectiveness.

POWCO BRAND insecticides cost you no more but pay you well. For details, call your nearest Powell representative, or write direct to our New York office.

John Powell & Company

Division of Olin Mathieson Chemical Corporation
One Park Ave., New York 16, N. Y.
Philadelphia, Pittsburgh, Chicago, Denver,
Fort Worth, Omaha, Atlanta

POWCO BRAND

DDT · TOXAPHENE · BHC · CHLORDANE · LINDANE · ROTENONE · SABADILLA
PYRETHRUM & PYRIN · ANTU · PIPERONYL BUTOXIDE · MALATHION · ALLETHRIN
TEPP · PARATHION · ALDRIN · DILAN · HEPTACHLOR · 2, 4-D & 2, 4, 5-T · FLY FLAKES

LOOK TO POWELL...FOR CONSISTENT, TROUBLE-FREE QUALITY

"Okay—ATTACLAY is a 'natural' for liquid toxicants . . . now, let me relax, will ya'?"

This ho-hum grasshopper just won't get hopped up over the huge volume of liquid toxicants formulated every season with Attaclay . . . but, his hopping days are over anyway with an Attaclay-based liquid toxicant on the way.

Attaclay's Great Sorptive Capacity makes it a "natural" for formulating liquid toxicants. It's the carrier and diluent that puts more of your dollar into *carrying*. It handles high or low concentrations of viscous or "watery" poisons, producing dust bases and wettable powders that are dry, free-flowing, lump-free.

Rapid, Uniform Impregnation. Non-abrasive Attaclay responds smoothly to blender agitation. Cycle times are cut . . . attrition milling or grinding steps that follow are fast. Blenders, mills, screens and conveyors show minimum wear.

Premium Products. Almost without fail dealers and growers put the stamp of "premium" on Attaclay-based products.

NEED A HAND in the form of literature, samples, technical help? Use the handy coupon for fast M & C service.

"BUY EARLY"—*makes good sense to processor, dealer, grower.*

ATTAPULGUS **ATTAPULGUS PRODUCTS** *from*

MINERALS & CHEMICALS CORPORATION OF AMERICA

9 ESSEX TURNPIKE, MENLO PARK, NEW JERSEY

ALWAYS A BETTER WAY...

MINERALS & CHEMICALS CORPORATION OF AMERICA
9 Essex Turnpike, Menlo Park, N.J.

Please send me:

- ☐ Complete, up-to-date technical literature
- ☐ Free sample of Attaclay

name _____ title _____

company _____

address _____

city _____ zone _____ state _____

WHEREVER YOUR SELLING AREA—

HEPTACHLOR

Means Insecticide Profits for YOU with the Big 1956 Soil Insect Campaign!

HERE'S HOW IT WORKS:

1 It's a big market

Soil insects can strike almost anywhere . . . that's why farmers need *Heptachlor* protection. For every 100 acres of cropland in your selling area there's a potential market of 50 gallons of Heptachlor. That's the big profit news for you. *Cash in!*

2 Heptachlor pre-sells this market for you

Key radio stations reaching millions of farmers, powerful state farm papers, and leading farm circulation newspapers will all carry hard-hitting ads to pre-sell this valuable market. *You cash in!*

3 Heptachlor provides tested "in store" selling aids

You tie in with this powerful Soil Insect merchandising program with colorful jumbo displays, window banners, folders and ad mats. They almost close the sale for you. Once again, *you cash in!*

PLUS ... PROVEN HEPTACHLOR PERFORMANCE

Recommended by state and Federal Experiment Stations, Heptachlor performance has been proven by years of successful soil insect control. Farmers know HEPTACHLOR is the name that means higher yields and bigger dollar income.

VELSICOL
CHEMICAL CORPORATION

VELSICOL

330 E. GRAND AVENUE CHICAGO 11, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES
General Offices and Laboratories 330 East Grand Avenue, Chicago 11, Illinois

MAIL THIS COUPON TODAY FOR DETAILS ON HOW YOU CAN TIE IN WITH THE BIG 1956 HEPTACHLOR SOIL INSECT PROGRAM

AC 26

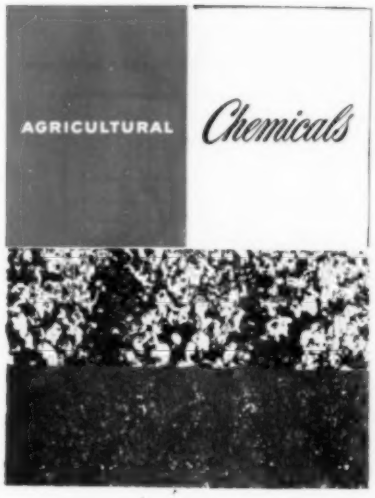
Please send me details on the 1956 Heptachlor Soil Insect Program.

My Name_____

Company Name_____

Address_____

City_____ State_____



Top Photo: Plot of cotton treated with 10 applications of 5% Bayer 17147 dust to control heavy infestations of boll weevil and pink bollworm. Brownsville, Tex., 1955. Bottom Photo: Plot of untreated cotton. See story on Bayer 17147, pages 32-33.

Publisher
Wayne E. Dorland
Managing Editor
Eleonore Kanar
Technical Editor
Edward Meier
Advertising Manager
Ralph Dorland
Circulation
Carolyn Kramer

Editorial Advisory Board
Dr. Alvin J. Cox
Lea S. Hitchner
Dr. S. E. A. McCallan
Dr. Charles Palm
Dr. Colin W. Whittaker

MEMBER AUDIT BUREAU OF CIRCULATIONS

Vol. 11, No. 2 February, 1956

AGRICULTURAL Chemicals

ARTICLES

EDITORIAL 29
THE ARK-MO PROCESS OF FERTILIZER GRANULATION 30
By J. C. Sharp
BAYER 17147 . . . A PROMISING NEW INSECTICIDE FOR COTTON PESTS 32
By C. F. Rainwater
TEMPERATURE AND MOISTURE RELATIONSHIPS IN GRANULATION 34
By Rodger C. Smith
FUNGICIDES AND THE MILLER PESTICIDE CHEMICALS AMENDMENT 37
By W. B. Rankin
SULFUR-SULFURIC ACID IN THE FERTILIZER INDUSTRY 38
By Vincent Sauchelli
NORTH CAROLINA PESTICIDE SCHOOL 41
COMPLEMENTARY CHEMICAL AND BIOTIC CONTROL OF PESTS 42
By B. R. Bartlett
GRANULATION WITH "URAMON" AMMONIA LIQUORS 45
By Ove F. Jensen
ROLE OF ENTOMOLOGY IN THE FUTURE OF AGRICULTURE 47
By George W. Irving
NE WEED CONFERENCE AND WEED SOCIETY OF AMERICA CONF. 48
NEW LIQUID MIXED FERTILIZER PLANT IN OPERATION 50
By C. E. Franklin

FEATURES

IN THE SPOTLIGHT THIS MONTH 6
FERTILIZER VIEWS AND NEWS 52
By Vincent Sauchelli
THE LISTENING POST 55
By Kelvin Dorward and Paul Miller
WASHINGTON REPORT 58
By Donald Lerch
TECHNICAL SECTION 61
INDUSTRY NEWS 69
SUPPLIERS' BULLETINS 87
INDUSTRY MEETING CALENDAR 89
PROFESSIONAL DIRECTORY 127
CLASSIFIED ADVERTISING 129
ADVERTISERS' INDEX 133
TALE ENDS 134

PUBLISHED monthly on the 1st by Industry Publications, Inc.

ADVERTISING and Editorials office, P. O. Box 31, Caldwell, New Jersey.

PUBLICATION Office: 123 Market Pl., Baltimore, Md.

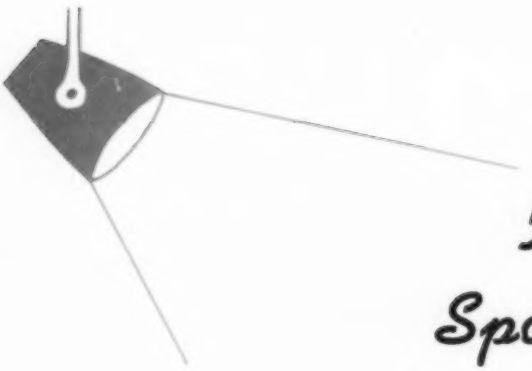
CHICAGO Office: 333 N. Michigan Blvd., Chicago, Ill.

ENTERED as second-class matter November 4, 1949 at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

SUBSCRIPTION RATES: United States, 1 year, $3.00; 2 years, $5.00. Canada and Pan American countries, 1 year, $4.00; 2 years, $7.00. All other foreign countries, 1 year, $9.00; 2 years, $15.

SINGLE COPIES: current issue: $0.50; all back numbers $1.00. Postage and handling charges for foreign countries on single copies: $1.00. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing. No claims allowed from subscribers arising from failure to notify the Circulation department of a change of address, or because a copy is "missing from files."

ADVERTISING RATES known on request. Closing date for copy—5th of month preceding month of issue.



In the Spotlight this Month

● **Lop-sided Fertilizer Programs** . . . are inefficient . . . Research and experience both prove it is more practical and profitable to apply complete fertilizers to pastures and meadows . . . See pg. 52-53.

● **New Cotton Insecticide** . . . Bayer 17147 called promising for control of boll weevil and other cotton pests. Even at low dosages gave consistently better control than any of the currently recommended insecticides . . . See pg. 32-33.

● **Liquid Mixed Fertilizers** . . . Phillips Petroleum reports on practical experience gained in operating a demonstration plant . . . and predicts that liquid fertilizers will experience the same phenomenal growth that has characterized anhydrous ammonia . . . See pg. 50-51.

● **The Ark-Mo Process** . . . Practical suggestions on the granulation of various grades of mixed fertilizers . . . suggested modifications in the original Ark-Mo process in the light of the first ten months of plant operation . . . See pg. 30-31.

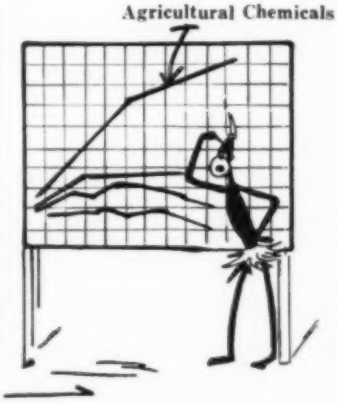
● **Natural Predators** . . . How serious is the threat from new and highly toxic non-selective insecticides? Are selective insecticides the answer to this problem? . . . See pg. 42-44.

● **Uramon Solutions** . . . Urea solutions afford satisfactory granulation from the standpoint of yield, desirable granule size, hardness of granule, appearance, free-flowing qualities, and comparative freedom from subsequent reactions that may induce excessive pile set or caking in bag storage . . . See pg. 45-46.

● **Role of Entomology** . . . Entomology is big business. Losses from insects in the United States, plus cost of control amounts to 4 billion dollars a year. That's big business in any man's language, an amount almost equal to the nation's entire corn crop . . . See pg. 47.

● **At Phytopath Conf.** . . . Two more diseases important to vegetable growers . . . downy mildew of lima beans and late blight of tomatoes . . . have been controlled experimentally with antibiotic sprays. The addition of copper to antibiotic sprays is found to contribute to disease control at low antibiotic dosages . . . See pg. 83.

Agricultural Chemicals



Puzzled?

You may be puzzled about what the stock market will do . . . but there can be no question about what magazine to read.

Agricultural Chemicals offers you some 60 editorial pages each month, devoted to the technical and practical developments of the agricultural chemicals industry . . . a balanced distribution of articles and news of interest to the manufacturer and distributor of insecticides, fertilizers, herbicides, etc.

A technically trained staff is at YOUR service to edit, and interpret the information YOU are interested in—news, feature articles, meeting reports.

You can't afford not to be a subscriber. Send in the card bound in on page 67 to start getting your copies now!

•

AGRICULTURAL CHEMICALS

P. O. BOX 31

CALDWELL, NEW JERSEY

AVOID... Emulsifier Overload!

Excess emulsifiers in your Pesticide concentrates are costly. Proper EMCOL levels with adequate "safety margins" will insure storageability and superior performance—at no extra cost—and in most cases, at lower costs.

These are typical EMULSOL recommended levels for EMCOLS with ample safety factor included

2 lb. Aldrin/gal.*	5.0%	1 lb. Lindane/gal.	5.0%
1 lb. B.H.C. gamma/gal.	3.0%	50% or 5 lb. Malathion/gal.	5.0%
4 lb. or 6 lb. Chlordane/gal.	5.0%	8 lb. Malathion/gal.	10.0%
2 lb. DDT/gal.	2.5%	2 lb. Methoxychlor/gal.	3.0%
1½ lb. Dieldrin/gal.	5.0%	4 lb. Strobane/gal.	5.0%
1.6 lb. Endrin/gal.	5.0%	8 lb. Strobane/gal.	8.0%
2 lb. Heptachlor/gal.	5.0%	6 lb. Toxaphene/gal.	3.0%

*U.S. Gallon

For details on the above and other insecticide or pesticide concentrates not listed here, consult your local EMULSOL technical representative or us directly—

EMULSOL CHEMICAL CORPORATION
a division of the Witco Chemical Company
59 EAST MADISON STREET • CHICAGO 3, ILLINOIS, U.S.A.

Why D-D® is becoming increasingly important in nematode control

Outstanding performance in all growing areas on a wide variety of nematode species—*plus* timely national advertising and merchandising make D-D the soil fumigant to push for bigger '56 profits.

More growers than ever before are realizing the benefits of soil fumigation. Many of these growers are using D-D . . . the soil fumigant proved effective in hundreds of tests and over years of commercial usage. Make sure you are getting your share of these profits by stocking, recommending, and selling D-D.

Your customers will find D-D easy to apply. One economical pre-plant treatment with simple tractor attachment or gravity flow plow equipment gives effective control for an entire growing season. The cost of D-D is repaid many times in increased yields of better quality crops.

Customers can apply D-D in the spring before planting or in the fall after harvest . . . whichever time is more convenient. With nematode control taken care of early, growers have more time for other jobs.

Here are the advantages your customers get when they use D-D

- Control of root knot and other nematodes
- Better crops through healthy root systems
- Easy application by gravity flow plow equipment or simple tractor attachment
- Economy . . . D-D more than pays for itself in increased yields.

Make bumper profits this season by recommending and selling D-D to your customers. It's the soil fumigant proved effective on thousands of acres of crops . . . you can recommend it with confidence. Technical information on D-D and its application is available from:

SHELL CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION
460 Park Avenue, New York 22, New York

SHELL

We Are Prepared!

This fertilizer season shipping facilities will be heavily taxed to meet the demand for potash.

Our loading and shipping facilities at Carlsbad are the most adequate in the industry.

As the peak period approaches, P.C.A.'s loading docks and shipping crews are prepared to serve you.

CALL ON US FOR YOUR POTASH NEEDS

P.C.A.
The SALT of the EARTH
RED MURIATE

POTASH COMPANY OF AMERICA

CARLSBAD, NEW MEXICO.

General Sales Office . . . 1625 Eye Street, N.W., Washington, D.C.
Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill.
Southern Sales Office . . . Candler Building, Atlanta, Ga.

The Model A Bagpaker* makes large tonnage bagging of free flowing materials a one man operation — and up to 350 tons can be bagged per 8 hour shift without overtime.

All the operator does is hang the empty bags on the filling spouts. Accurate weighing, settling and sewing are fully automatic.

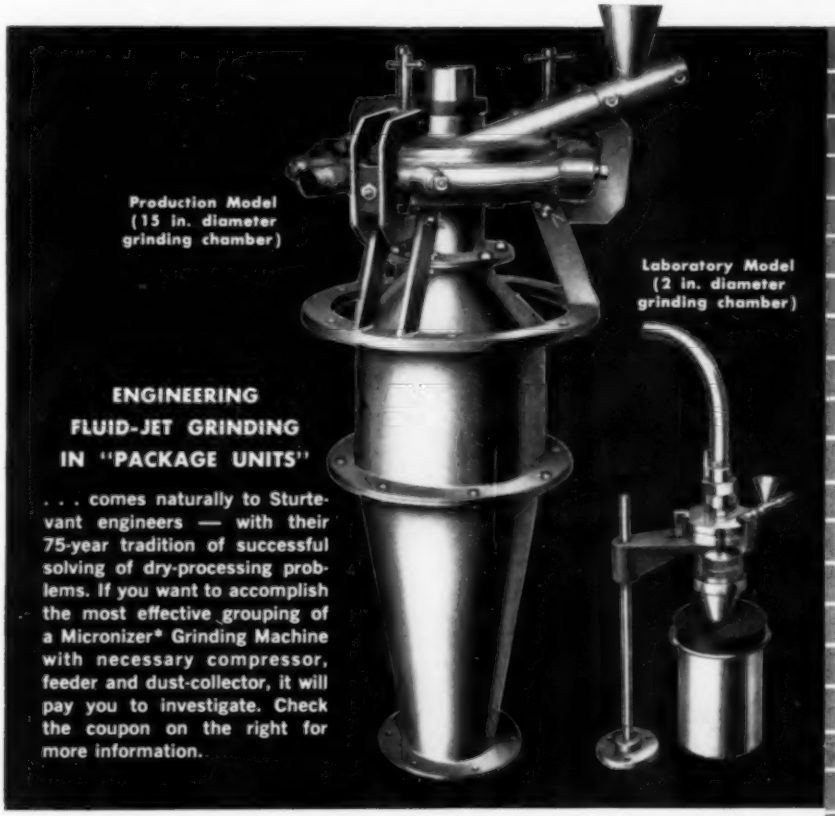
Engineered and manufactured by Bagpak Multiwall Bag experts, the Model A Bagpaker* is designed for reliability and durability. It can be depended upon to give years of service — and to pay for itself in as little as one year. If you are interested in the utmost in economy and efficiency in packaging bulk materials, you'll want to have all the details on this efficient machine. For complete information on how the Model A can fit into your packaging picture write to:

International Paper Company, Bagpak Division
220 E. 42 Street, New York 17

International Paper COMPANY
BAGPAK DIVISION

BRANCH OFFICES: Atlanta · Baltimore · Boston · Chicago · Cincinnati · Cleveland · Dallas · Denver · Des Moines · Detroit · Kansas City, Kansas · Los Angeles · Minneapolis · New Orleans · Philadelphia · St. Louis · San Francisco · IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa, Toronto

High Speed Reduction to Micron Sizes — No Attritional Heat!



ENGINEERING FLUID-JET GRINDING IN "PACKAGE UNITS"

. . . comes naturally to Sturtevant engineers — with their 75-year tradition of successful solving of dry-processing problems. If you want to accomplish the most effective grouping of a Micronizer* Grinding Machine with necessary compressor, feeder and dust-collector, it will pay you to investigate. Check the coupon on the right for more information.

Sturtevant Micronizer* Grinding Machines Give Greater Finenesses than Tube or Roller Mills

Look at the record! 30 inch model reduced titanium dioxide to 1 micron and finer at solid feed rate of 2250 lbs. per hr. 24 inch model reduced DDT (50%) to 3.5 average microns — 1200-1400 lbs. per hr. 8 inch model reduced Procaine—Penicillin—to 5 to 20 microns—up to 20 lbs. per hr. Couldn't you use milling performances like these?

No moving parts. The particles grind each other. High-speed rotation and violent grinding impact of particles are caused by jets of compressed air or steam at angles to the periphery of the shallow grinding chamber. There are no problems of attritional heat. Centrifugal force keeps over-sized particles in the grinding zone. Cyclone action in the central section classifies and collects the fines for bagging.

Instant accessibility, easy cleaning. Micronizer* Grinding Machines come in seven sizes — each one constructed for quick accessibility and easy maintenance (typified by the "OPEN DOOR" design in other Sturtevant equipment). Grinding chambers range from the 2 in. laboratory size with ½ lb. per hr. capacity to the 30 in. size which handles up to 3000 lbs. per hr.

* Registered trademark of Sturtevant Mill Co.

STURTEVANT

Dry Processing Equipment

The "OPEN DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

My dry-process materials are: _____

Desired capacity is: _____

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____

STURTEVANT MILL COMPANY 123 Clayton Street, Boston 22, Mass.

Please send me your Micronizer* Bulletin ☐
Also bulletins on machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ SEPARATING ☐ BLENDING ☐ MIXING
☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

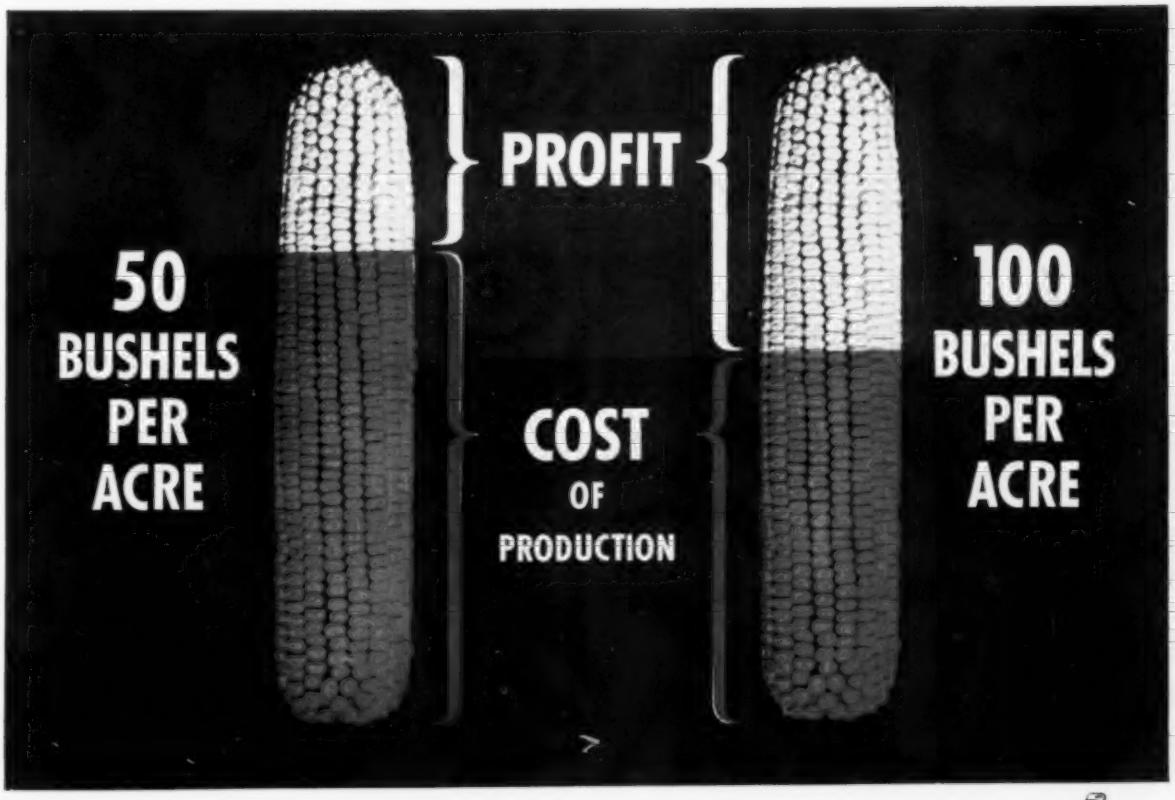
Again we tell 3½ million farmers

Fertilizer Grows Farm Profits

The advertisement on the opposite page is the second in a series in a powerful and continuing campaign directed to the attention of more than 3½ MILLION readers of farm magazines.

Nitrogen Division, Allied Chemical & Dye Corporation, is conducting this campaign to serve the best interests of the farmer, the fertilizer manufacturer, the county agent, the country banker, the experiment station, the extension service and all others interested in a profitable agriculture.

This campaign is designed to be helpful to you in your efforts to serve the farmer. We trust that it meets with your approval and we greatly appreciate any comments or suggestions you may wish to send us.



MORE FERTILIZER MEANS MORE PROFIT PER EAR

More fertilizer per acre means more bushels per acre added to your yield at very low extra cost. This reduces your cost of production per ear or per bushel and increases your net profit.

For example the corn ears pictured above show how fertilizer worked for some typical corn growers on good land. Fixed expenses, such as land-use, management, labor and machinery were the same whether the yield was 50 bushels or 100 bushels per acre.

To increase the yield to 100 bushels the only extra investment required was MORE FERTILIZER per acre, more seed for closer spacing and extra labor for harvesting the larger yield. Fifty extra bushels per acre were added to the yield at very low extra cost and far greater profit per bushel.

More fertilizer per acre is your best-paying investment. Results vary on different crops and soils but the basic economic fact prevails: a bushel or a pound of any crop can be produced much more economically when the yield is high than when the yield is low. More fertilizer is the direct route to high yields.

The price of fertilizer has not gone up like the prices of many other things the farmer buys. Returns from thousands of tests show that $1 invested in fertilizer produces an average return of $3.75 in extra yields. On many crops the return is much higher.

Fertilizer is your best investment. Fertilizer reduces your cost of production per bushel and increases your net profit. Use more fertilizer this year!

The fertilizer industry serves the farmer. Nitrogen Division serves the fertilizer industry as America's leading supplier of nitrogen for use in mixed fertilizers.

See Your County Agent

Ask your County Agent to recommend the analyses and the amounts of fertilizers best suited to produce big yields of the crops you grow on your soil. His advice to you is based on the latest official recommendations from your Extension Service and Experiment Station.

See Your Banker

Bankers are alert to good investments. They know that fertilizer pays a big return in the short period of a growing season. If you need money to buy more fertilizer, most bankers consider the extra yields produced by fertilizer as an excellent risk.

See Your Dealer

Your fertilizer dealer can supply you with a good brand of fertilizer in the amounts and analyses as recommended by your County Agent. Help your dealer to get your fertilizer to you on time by placing your order early and accepting prompt delivery. Use more fertilizer than ever before and have it on hand when you need it. Remember, fertilizer grows farm profits. Use enough to really pay you big!

NITROGEN DIVISION Allied Chemical & Dye Corporation
New York 6, N. Y. • Hopewell, Va. • Ironton, Ohio
Omaha 7, Neb. • Indianapolis 20, Ind. • Columbia 1, S. C.
Atlanta 3, Ga. • Kalamazoo, Mich. • Columbia, Mo.

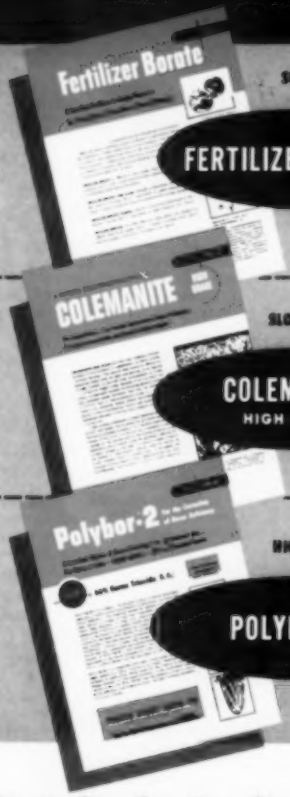
Fertilizer Grows Farm Profits

To Increase Profits...

Give crops needed Boron!

Write for this Poster—
of interest to everyone connected in any way with improving agriculture.

3 TYPES OF BORATES... TO CORRECT AND PREVENT BORON DEFICIENCY!



SOLUBLE

FERTILIZER BORATE

A sodium borate ore concentrate rich in boron—offers the most economical source of boron for agriculture. This material is suitable for BORATING fertilizers or for use as dry application direct to soil. Fertilizer Borate is offered in two grades with choice of coarse or fine mesh. High Grade contains 44% B_2O_3, Regular contains 34% B_2O_3. Send for Bulletin PF-3.

SLOWLY SOLUBLE

COLEMANITE
HIGH GRADE

A natural calcium borate mineral. This slowly soluble lime borate is offered for conditions where soils are light and porous, or in regions of high rainfall. The slow and extended release of available boron by Colemanite as it weathers is advantageous to cotton and boron-sensitive crops which do require boron. Content in B_2O_3 ranges from 32% to 35%. Send for Bulletin PF-2.

HIGHLY SOLUBLE

POLYBOR-2

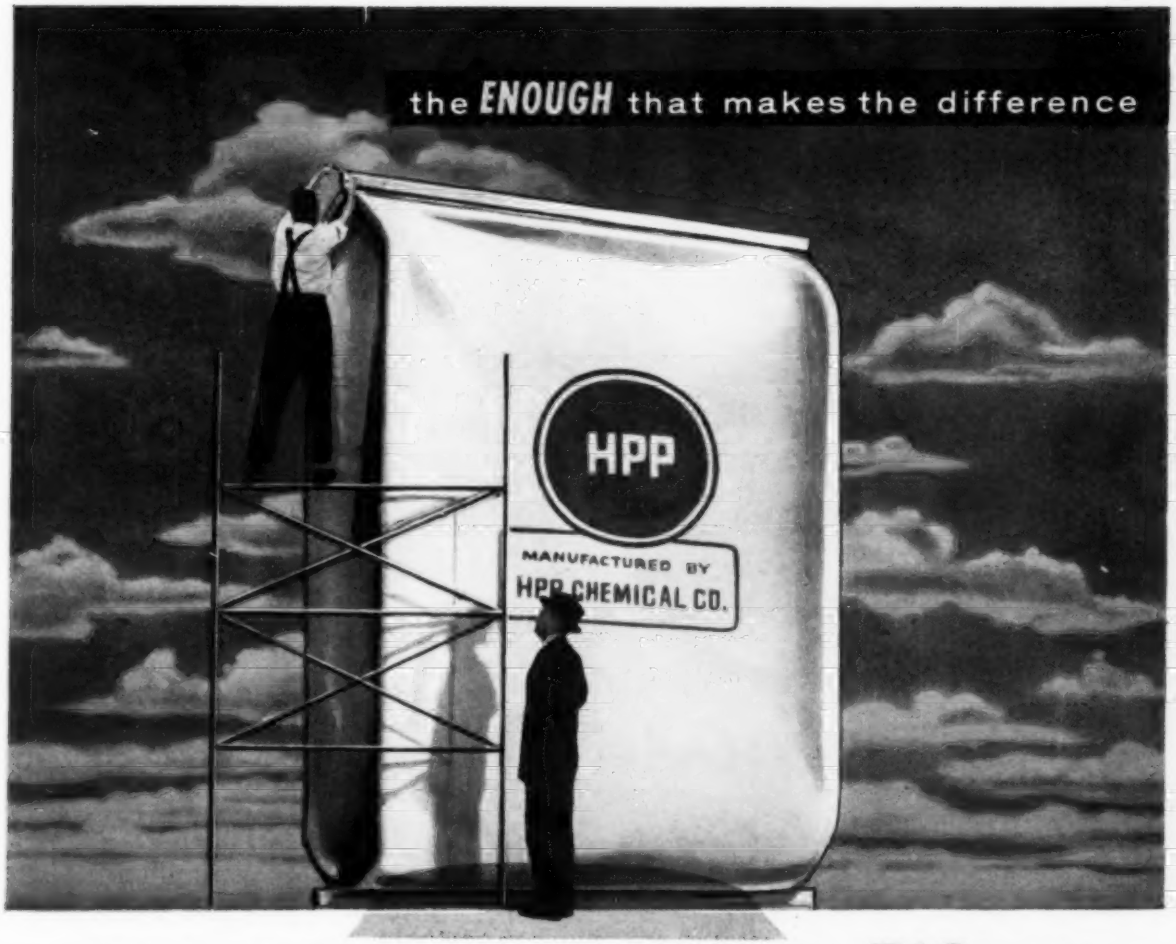
Contains a higher percentage of available boron than any comparable agricultural borate on the market . . . 20.5% Boron or 66% B_2O_3. This material should be applied as a spray or dust, directly to the foliage of crops. Polybor-2 is compatible with insecticides and fungicides currently in use and may be applied in the same solutions in the established routine culture of crops. Send for Bulletin PF-4.

Write today for Service Bulletins:

AUBURN, ALABAMA — 1st National Bank Building
PORTLAND, OREGON — 1504 N.W. Johnson Street
HOUSTON, TEXAS — 1503 Hadley Street
CALGARY, ALTA., CANADA — 2031 Fortieth Ave., S.W.

PACIFIC COAST BORAX CO.
DIVISION OF BORAX CONSOLIDATED, LIMITED
630 SHATTO PLACE, LOS ANGELES, CALIF. • 100 PARK AVE., NEW YORK CITY

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS



OPENING MULTIWALLS WAS ONCE A BIG JOB!

It used to take a multitude of sharp tools, brute force and precious man hours to put Multiwall packaged products to work. Jagged, random tearing added to waste and frayed tempers of cost-minded management.

An accepted occupational hazard for multiwalls? Hudson engineers weren't content until they developed the "SNAP-OPEN" Sack.

Now, even a 10 year old child, without tools, can open a Hudson multiwall sack with ease.

A series of tiny perforations along the top turns the trick . . . controls the line of tear without ripping. Try Hudson "SNAP-OPEN" Sacks and put *more sell* in your packaging.

ABOUT TO ORDER MULTIWALLS?
SPECIFY "SNAP-OPEN" by HUDSON

HUDSON
SNAP OPEN
MULTIWALLS

HUDSON PULP & PAPER CORP.
477 MADISON AVENUE • N.Y. 22, N.Y.
Plants at CHARLOTTE, N. C. • PALATKA, FLA.
PINE BLUFF, ARK. • WELLSBURG, W. VA.

HUDSON PULP & PAPER CORP.
477 MADISON AVENUE • NEW YORK 22, N. Y.

YES . . . send us information on your Snap-Open Sack and its sales building opportunities.

NAME_____ TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

BRINGS TO THE

its unlimited supply of a wide variety of papers for the prompt production and delivery of Multiwall Paper Shipping Sacks.

NOW Raymond, as a wholly owned and integrated operation, has the outstanding advantage of Albemarle's vast paper manufacturing resources from forest to the finest Multiwall Kraft Paper, including specialty papers such as asphalt laminated, colored kraft, creped kraft, waxed kraft, and wet-strength paper.

BAG CORPORATION, Middletown, Ohio

Pesticide emulsion problems?

THIS MAN COULD BE ON HIS WAY TO SEE YOU WITH THE ANSWERS

He's one of Armour's staff of emulsion specialists. His job is to help you find *specific* emulsifiers that satisfy *your* requirements for stability and "flash" dispersion. The skill and experience of Armour specialists are available to you at all times. We will select and send you a group of Armour emulsifiers best suited for your testing if you fill in the coupon below. Or, if any of your insecticide or herbicide formulation problems require special laboratory work, an Armour emulsion specialist will travel to your plant and work right along with you.

In the laboratory, Armour specialists develop both non-ionic and cationic emulsifiers. Armour cationic emulsifiers are generally insensitive to varying water hardness. Their herbicidal concentrates are clear and soluble at *any* dilution with fuel or diesel oil. They will emulsify the most potent toxicants at concentrations as low as 2%! That is why less of an Armour cationic emulsifier is required to do the job. Exact specifications insure their uniform, dependable performance.

Under actual field conditions, Armour emulsifiers give immediate dispersions and rapid spreading with minimum runoff and loss. Only after passing the strictest tests and receiving industry acceptance are emulsifiers added to the Armour line. Armour emulsifiers are versatile—one may serve many different formulations. This reduces inventories and simplifies processing. The coupon will bring you further information and samples of outstanding Armour emulsifiers.

FILL IN AND MAIL THIS COUPON TODAY!

Formulation requirements:

Type toxicants used.....

Type solvent used.....

Lbs. Toxicant/gal. of concentrate.....

Water hardness range:.....ppm.

Emulsion stability required.....

Please send me:

☐ Samples ☐ Information

☐ Have technical representative call

Name.....Title.....

Firm.....

Address.....

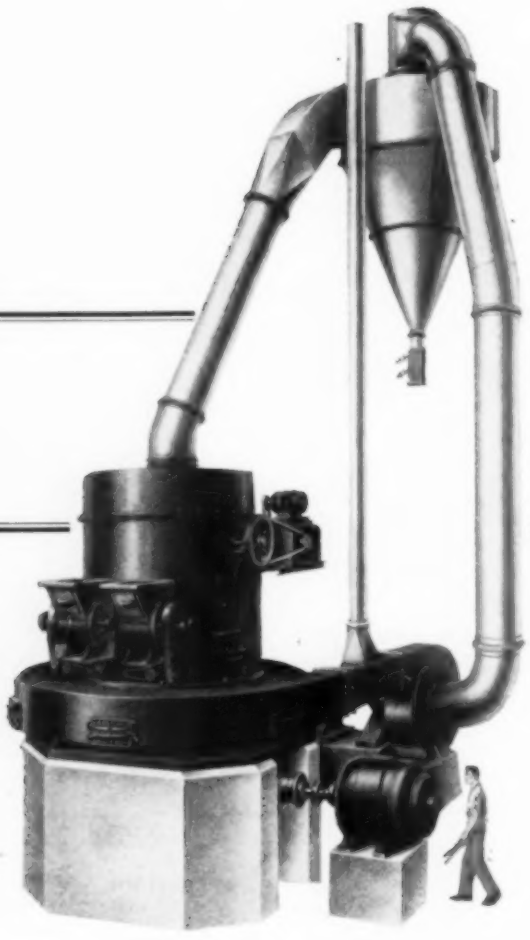
City.....Zone....State.....

A 2

ARMOUR CHEMICAL DIVISION

© Market Development Department
1355 W. 31st St. Chicago 9, Ill.

RAYMOND SUPER ROLLER MILLS



Raymond Super Roller Mill with dual feeder and Whizzer Air Separator.

Write for Raymond Catalog of Roller Mills #79

For Large Capacity *Production of* PHOSPHATE ROCK

If your plant output ranges up to 30 tons or more per hour, you can utilize a Raymond Super Roller Mill with important advantages in operation, as well as substantial reductions in cost.

This big machine enables you to combine the entire production of phosphate rock in a single unit of equipment — a dustless, automatic, continuous process. In addition, it also —

CONSERVES PLANT SPACE
CENTRALIZES OPERATIONS
SIMPLIFIES MATERIAL HANDLING
SAVES ON INSTALLATION, MAINTENANCE AND SUPERVISION COSTS

The Raymond line of Standard Roller Mills and Super Roller Mills provide a wide choice of sizes and types of mills to suit your needs.

Over 200 Raymond installations are successfully grinding all grades of phosphate rock for both acidulation purposes and direct application. For proved economy, specify a Raymond Roller Mill in your plant expansion program.

Raymond Roller Mills are equally efficient in pulverizing agstone, chemicals, insecticide mixtures and other non-metallic minerals.

COMBUSTION ENGINEERING, INC.
Raymond Division

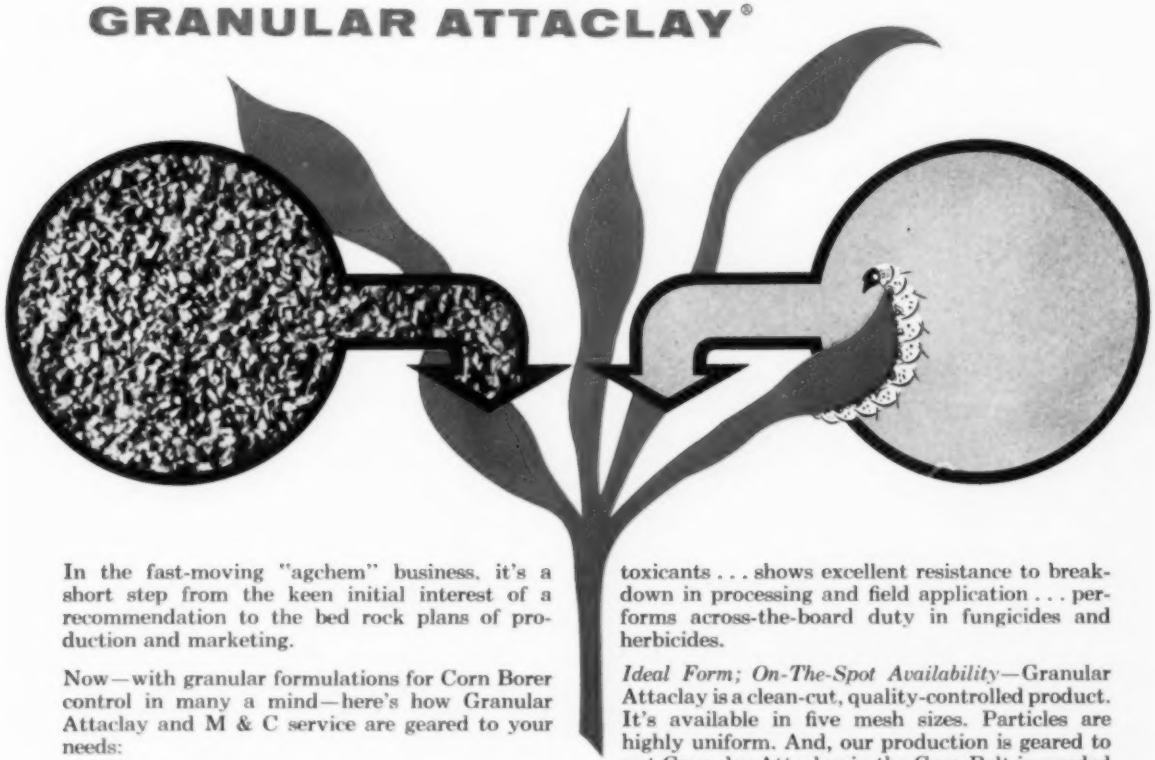
1314 NORTH BRANCH ST.
CHICAGO 22, ILLINOIS

SALES OFFICES IN PRINCIPAL CITIES

Combustion Engineering-Superheater, Ltd., Montreal, Canada

a timely and important message to formulators

For Your **Corn Borer Granular Pesticides** *standardize on the* **original, pioneer carrier–** **GRANULAR ATTACLAY®**



In the fast-moving "agchem" business, it's a short step from the keen initial interest of a recommendation to the bed rock plans of production and marketing.

Now—with granular formulations for Corn Borer control in many a mind—here's how Granular Attaclay and M & C service are geared to your needs:

Good History—Technological development in our own laboratories has produced the excellent properties in today's production of granular carriers for pesticides.

The Route To Superior Products—Granular Attaclay is highly sorptive . . . combines ideally with toxicants . . . shows excellent resistance to breakdown in processing and field application . . . performs across-the-board duty in fungicides and herbicides.

Ideal Form; On-The-Spot Availability—Granular Attaclay is a clean-cut, quality-controlled product. It's available in five mesh sizes. Particles are highly uniform. And, our production is geared to put Granular Attaclay in the Corn Belt in needed amounts at the right time.

LET'S WORK TOGETHER

Just off press—an edition of Pesticide Digest filled with facts about corn borer control and granular pesticides. Use the coupon for free copy, samples, technical help.

"BUY EARLY" —*makes good sense to processor, dealer, grower.*

ATTAPULGUS **ATTAPULGUS PRODUCTS** *from*

MINERALS & CHEMICALS CORPORATION OF AMERICA

9 ESSEX TURNPIKE, MENLO PARK, NEW JERSEY

ALWAYS A BETTER WAY...

MINERALS & CHEMICALS CORPORATION OF AMERICA
9 Essex Turnpike, Menlo Park, N. J.

Please send me:

- ☐ Pesticide Digest described above
- ☐ Test samples of Granular Attaclay for the following applications:

_____

_____

name _____ title _____

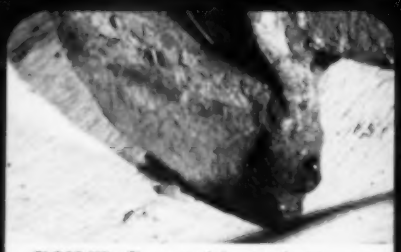
company _____

address _____

city _____ zone _____ state _____

CORN PLANTER ATTACHMENT—Liquid fertilizer streams from modified corn planter shoe beneath corn as it is planted. Clod shield protects the tube feeding liquid. (Shoe is above ground for demonstration purposes.)

CULTIVATOR ATTACHMENT—With a rig like this, it's easy for a farmer to fertilize as he cultivates. Use of complete liquid fertilizer eliminates need for carrying heavy bags.



CLOSE-UP—The special attachment at bottom of shoe on corn planter delivers fertilizer into soil; permits application of liquid simultaneously with planting.

Liquid fertilizer: progress report

New applicator equipment means longer selling season for liquid fertilizer formulators

New applicating equipment is doing much to level out historic spring-fall peaks in fertilizer application. Ease of liquid application encourages fertilizing almost any month of the year. Pictured above are two examples of equipment progress: (1) A new modification to permit application at time corn is planted, and (2) A cultivator attachment which permits side dressing of crops with liquid fertilizer.

AN ASSURED SUPPLY. Your supply of phosphatic fertilizer solution is assured by Monsanto, world's largest producer of elemental phosphorus. Formulators: Send today for booklet "Formulating Complete Liquid Fertilizers." Write MONSANTO CHEMICAL COMPANY, Inorganic Chemicals Division, 710 North Twelfth Boulevard, St. Louis 1, Missouri.

Shoe attachment manufactured by Sawtelle & Rosprim to specifications of Agriform Company, Inc.

MONSANTO
CHEMICALS—PLASTICS

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

International MINERALS CHEMICALS

Even the night watch knows...

it's today's most wanted Triple Super

•Result:

Round-the-clock production to meet your needs for International's new

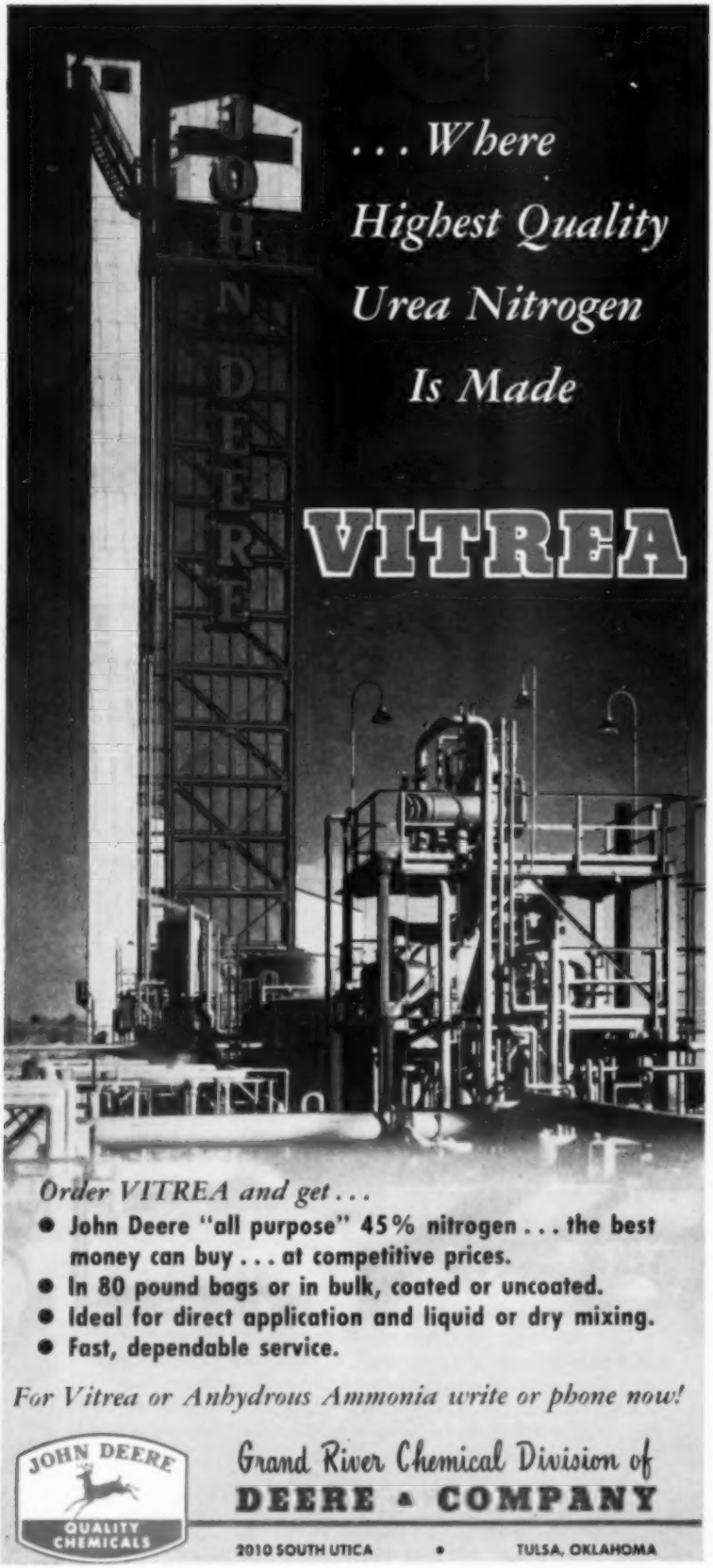
TRIPLE Superphosphate

Twenty-four hours a day, seven days a week, International turns out an ever-increasing supply of a superior Triple Superphosphate. Its uniformly fine texture, greater solubility, higher content of usable phosphorus and low moisture . . . plus facilities for prompt delivery . . . make International's Triple Super among today's most-wanted phosphate products.

Like other plant food manufacturers, you'll discover that International's unique processing, natural curing and modern handling methods have produced a Triple Super that solves many problems before they start . . . gives you better ammoniation, higher A.P.A. and a finished product that's more acceptable to your customers. Write or wire for samples and quotations.

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Phosphate Chemicals Division • General Offices: 20 North Wacker Drive, Chicago 6


. . . Where
Highest Quality
Urea Nitrogen
Is Made
VITREA
Order VITREA and get . . .
• John Deere "all purpose" 45% nitrogen . . . the best money can buy . . . at competitive prices.
• In 80 pound bags or in bulk, coated or uncoated.
• Ideal for direct application and liquid or dry mixing.
• Fast, dependable service.
For Vitrea or Anhydrous Ammonia write or phone now!
JOHN DEERE
QUALITY CHEMICALS
Grand River Chemical Division of
DEERE & COMPANY
2010 SOUTH UTICA • TULSA, OKLAHOMA

News Brevities

A. J. WEITH was recently advanced to sales manager of American Cyanamid Company's petrochemicals department. Petrochemicals, a department of the Organic Chemicals Division, handles the sales of principal products of Cyanamid's Fortier Plant in New Orleans, La.

AC

ALFRED P. RIMLINGER has been named export manager of the Antara Chemicals Division of General Aniline & Film Corp., New York. He succeeds Paul F. Hand who was recently appointed assistant to the president of GAF.

AC

CANADIAN GULF OIL CO., Pittsburgh, a subsidiary of Gulf Oil Corp., plans construction of a 225-ton-a-day sulfur plant at its Pincher Creek field in Alberta, Canada.

AC

WALTER A. ALLEN, Pittstown, N.J. died last month after a short illness. He operated a fertilizer and insecticide plant in Pittstown.

AC

E. T. YORK, JR. assumed managership of the northeast territory for the American Potash Institute, with headquarters in Washington, D. C. This follows the retirement of S. D. Gray who had held that position since the formation of the Institute in 1935.

AC

DUANE R. STONELEIGH was recently elected president and chief executive officer of the City Baking Co., New York. He was formerly with Mathieson Chemical Co.

AC

G. L. BRIDGER, Davison Chemical Co., has been elected chairman of the American Chemical Society's Division of Fertilizer and Soil Chemistry for 1956. He succeeds G. H. Serviss, of the GLF Soil Building Service.

AC

J. T. CLELAND was recently appointed sales manager of the Dallas branch of the Chase Bag Co.

The first ammonia plant in the Intermountain Area

Blaw-Knox engineers have designed, and now are constructing a new anhydrous ammonia and fertilizer plant for U. S. Steel's Columbia-Geneva Steel Division at Geneva, Utah. It is not only the first anhydrous ammonia plant for the Mountain States region, but is also the first installation of its kind in a major steel plant in this country. Raw coke oven gas is used as the source of hydrogen for ammonia synthesis.

This new facility will produce high quality fertilizers which are in wide demand. An annual total of over 100,000 tons of products will be available for shipment. This is a sizable volume on a regional basis, making the installation a significant addition to the expanding agricultural and processing industries of the Intermountain and Northwest areas.

Why not discuss your expansion plans—new plants or modernization of existing ones—with Blaw-Knox engineers? We welcome the opportunity to submit our recommendations.

This new Geneva Works project includes:

1. A 200-tons-per-day anhydrous ammonia plant.
2. A nitric acid plant.
3. A fertilizer grade ammonium nitrate plant, producing both solid and solution forms of the product.
4. The necessary complement of auxiliary units, including administration and service buildings, utilities systems, warehouses and extensive handling, bagging, storage, and shipping facilities.

BLAW-KNOX COMPANY

Chemical Plants Division

Pittsburgh 22, Pennsylvania / Chicago 1, Illinois

Are you using

OUR IMPROVED

DUVAL

Muriate of Potash ?

• HIGH ANALYSIS
• IMPROVED PHYSICAL CONDITION

DUVAL SULPHUR and POTASH CO.

Modern Plant and Refinery at Carlsbad, New Mexico

Please address communications to

ASHCRAFT-WILKINSON CO.

Exclusive Distributors

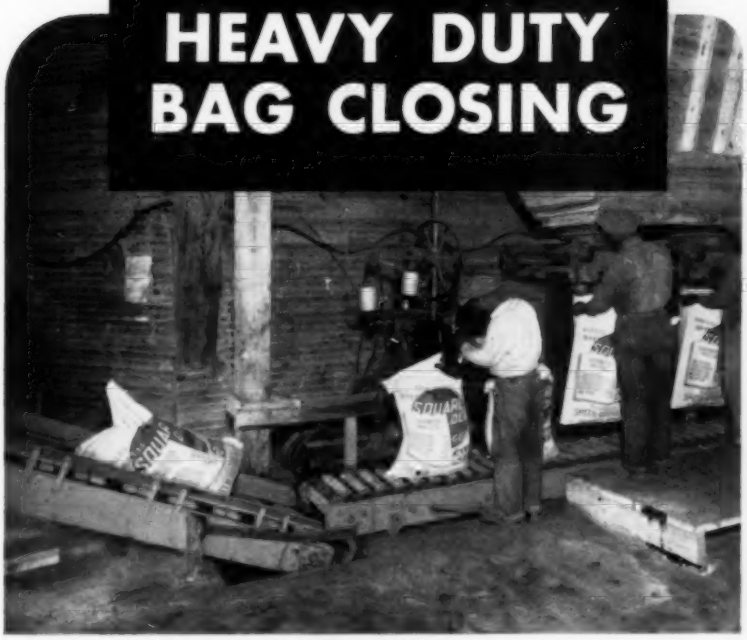
ATLANTA, GEORGIA

Cable Address: Ashcraft

District Offices

NORFOLK, VA. • CHARLESTON, S.C. • TAMPA, FLA.
JACKSON, MISS. • COLUMBUS, OHIO

HEAVY DUTY BAG CLOSING



— calls for

Union Special®

equipment!

UNION SPECIAL builds sewing heads and auxiliary equipment for closing all types and sizes of filled bags. These sewing heads set the standard the world over for speed, economy, and dependability — wherever the product is bagged. They stand up longer in all kinds of service and under the most severe working conditions. They are capable of high production day-in and day-out. For detailed information, ask for a copy of Bulletin No. 200. See our nearest representative or write today.

Union Special MACHINE COMPANY
447 N. Franklin St., Chicago 10, Ill.

● SEND FOR BULLETIN No. 200

STYLE 20500 B

This heavy duty unit is designed for closing 100 lb. textile or multiwall paper bags at rates up to 3,840 bags per 8 hr. day. Gear driven horizontal and inclined conveyor. Counterbalanced sewing head easily adjustable for height of bag. Sewing speed synchronized with conveyor speed. Choice of controls.

Announcing... MICRO-CEL®

a new insecticide absorbent-grinding aid that cuts formulation costs

Developed by Johns-Manville research . . . provides lower cost 75% DDT wettables for export

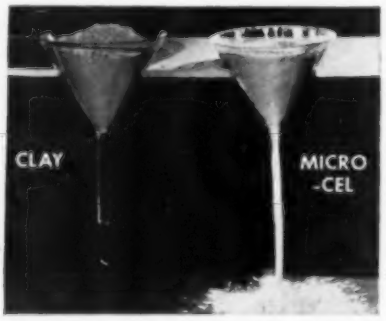
Johns-Manville has developed a new line of synthetic calcium silicates with unusually high absorptive capacities, large surface area, small particle size and excellent dry-flow properties. Called Micro-Cel, this new diluent is designed specifically for the production of free-flowing high percentage concentrates with either dry, viscous or liquid poisons.

Among the high concentrate wettable powders which have proven commercially practical are:

70% TOXAPHENE · 15% ARAMITE · 75% DDT
50% HEPTACHLOR · 75% DIELDRIN

Cuts costs to a new low

The high absorption of Micro-Cel permits the use of greater amounts of low-cost diluents. In addition, this high absorption results in a lower surfactant cost. All this means substantial formulation savings.



Flows like a liquid—Micro-Cel maintains its exceptional free-flow properties even after absorbing high concentrations of poisons.

Excellent storage properties

Formulations of 75 per cent DDT wettable powders based on Micro-Cel, as developed by Johns-Manville Research, will meet government specifications. Suspension values after storage of 1.5 to 2.0 can be achieved.

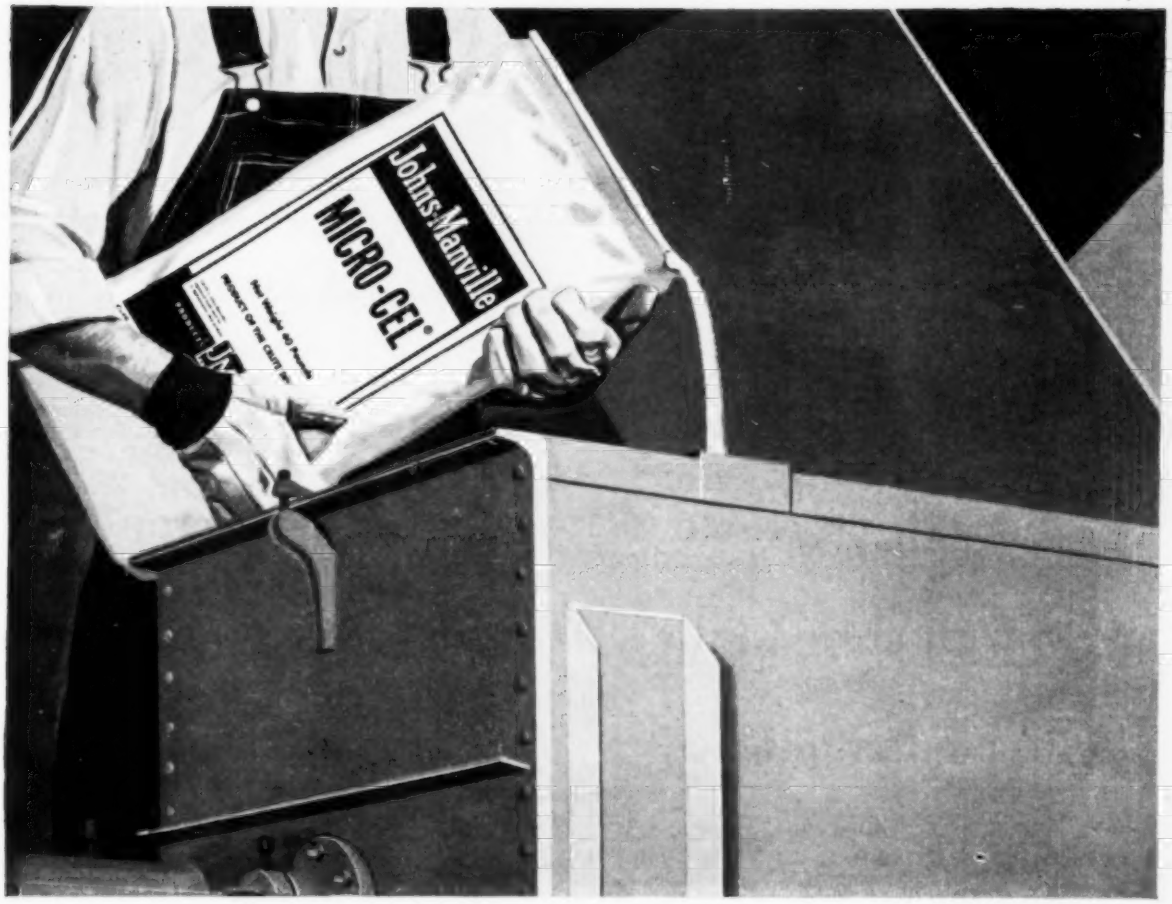
Meets tropical storage test—Suspension values of 1.5 to 2.0 after storage can be achieved in 75% DDT wettable powder formulation when based on Micro-Cel.

Dust concentrates

As a grinding aid in the preparation of dust concentrates, Micro-Cel's high absorptive capacity, free flowability and fine particle size of less than 0.1 micron make possible preparation of higher concentrates at lower costs. Examples of dry dust concentrates which have been proven commercially practical are:

70% TOXAPHENE · 50% ARAMITE
50% HEPTACHLOR

Johns-Manville MICRO



Micro-Cel for fertilizers

Micro-Cel is especially effective against caking of deliquescent products. It provides excellent insurance against caking of fertilizer compounds even after prolonged storage.

Test quantities and formulations available

Micro-Cel is now being produced on a pilot plant basis. Full-scale production is anticipated early in 1956. Sample quantities, as well as limited carload shipments for plant tests, are now available. We will also send you further data and formulations developed and tested in our laboratory for whichever poisons are of interest to you. If you desire, a Celite engineer will be glad to work with you in adapting Micro-Cel to your particular requirements and specifications. Write now in order to be ready with new improved products for the next crop year.

TYPICAL PROPERTIES OF MICRO-CEL GRADES

Grade	Color	Absorption % by Weight Oil	Absorption % by Weight Water	Density Loose Weight lbs./cu. ft.	Surface Area Sq. Meters / gram
8A	off-white	400	425	8	150
8B	off-white	225	200	15	150
8C	white	400	425	9	175
8D	off-white	300	350	12	100
8E	off-white	425	475	6	95

Average ultimate particle size is in range of 0.02-0.07 microns
pH—8.0-10.0

Johns-Manville, Box 60, New York 16, N. Y.
In Canada: Port Credit, Ontario.

☐ Please send me further information and samples of Micro-Cel. I am also interested in formulations for the following poisons:

_____

☐ Please have your local representative contact me.

Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

-CEL SYNTHETIC CALCIUM SILICATE

A PRODUCT OF THE CELITE DIVISION

MALATHION

is the answer to so many insect control problems:

kills aphids and mites and many other insect pests on 26 vegetable and field crops and on 15 fruit crops...kills DDT-resistant flies ...kills poultry mites ...protects ornamentals against practically every insect pest.

MALATHION offers so many advantages:

- Superior insect control together with a wide margin of safety in handling.
- No residue problems on crops—can be applied as close as 72 hours before harvest on many crops.
- Compatibility with most other commonly used insecticides and fungicides.
- For fly control, malathion is the *preferred* insecticide, recommended by all 48 states and the USDA.

Malathion insecticides are available from well-known manufacturers, under their own trade names, in wettable powder, emulsifiable liquid, dust and baits to fill every need.

DEALERS:
Get your share of malathion profits—carry a complete line of malathion insecticides for the important uses in your area.

Producers of:
AERO® Cyanamid: Fertilizers—Defoliants—Herbicides
AEROPRILLS® Ammonium Nitrate Fertilizer
AERO® Ammonium Sulphate
AMANOL® Nitrogen Solutions
ANHYDROUS AMMONIA
PHOSPHATES for Acidulation and Direct Application
THIOPHOS® Parathion Technical
MALATHION Technical
CYANOGAS® Calcium Cyanide Fumigants
HCN Fumigants
POTASSIUM CYANATE Weedkiller for Agriculture and Turf
®Trade-mark

Write for free literature

CYANAMID

AMERICAN CYANAMID COMPANY
AGRICULTURAL CHEMICALS DIVISION
30 Rockefeller Plaza, New York 20, N. Y.

Editorial
COMMENTS

IT is perhaps a little early, in late January, before the frost is even out of the ground, to start predicting a big year for insecticide sales this coming season. But even the most pessimistic might be willing to admit that the prospects for a profitable year in 1956 seem quite good at this stage, . . . better than for several seasons back.

To begin with, there are fewer basic producers than there were a few years back, . . . a result of the inevitable attrition that follows several years of comparatively unprofitable operations. Second, stocks are down, because of the substantial increase in volume of business done in the domestic market last season, plus the important foreign demand which has been built up over the past few years for American pesticides. Third, insect populations threaten to be on the high side for 1956, based on all counts of overwintering pests reported to date.

It is a long step from February to May and June, of course, and what looks like a good year for insecticide sales could change, as it has so often in the past. But there is still a fourth factor to be dealt with this year, . . . the imperative necessity of making a profit faced by everyone in the agricultural insecticide business. There are few firms, all the way down the line from basic producers through formulators and distributors, who can afford another year of unprofitable operations. We get a feeling that if demand is at all strong this season, the price tone will be much firmer.

NOW *you going to keep 'em down on the farm, after the parit-ee?* One sure way is to show them that they can increase their profits and improve their economic position by efficient use of fertilizers and insecticides.

A number of suppliers to the agricultural chemical industry have proved that. Prominent among them have been Union Bag & Paper Corp. and Nitrogen Division, who recently have been trying to give some assistance to the men on the farm who are faced with that old bugaboo, the "cost-price squeeze." Union Bag has been sending articles to the editors of 2500 weekly farm papers, telling the advantages of good fertilizer practices in successful farm management. Nitrogen Division, meanwhile, has launched a full-page color advertising campaign in leading farm papers, advising 3,500,000 farmers that fertilizer not only grows crops, but profits as well.

Unselfish efforts like these will go far toward helping the farmer improve his lot, and in the long run stand to help manufacturers and distributors of fertilizers as well.

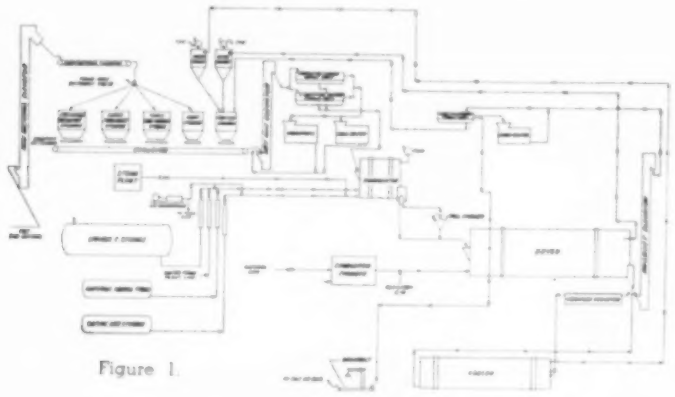


Figure I.

Granulation at the

SINCE March 7, 1955, when the Ark-Mo Plant went through its shake-down run, much valuable information has been developed on the granulation of many grades of mixed fertilizers, using the most economical formulas, based on present supply of raw materials. Basically, plant design has proven sound, but experience has shown us where some changes will be beneficial. These changes are being recommended to other companies converting to granulation.

This discussion describes the present process and indicates desirable changes.

Solids

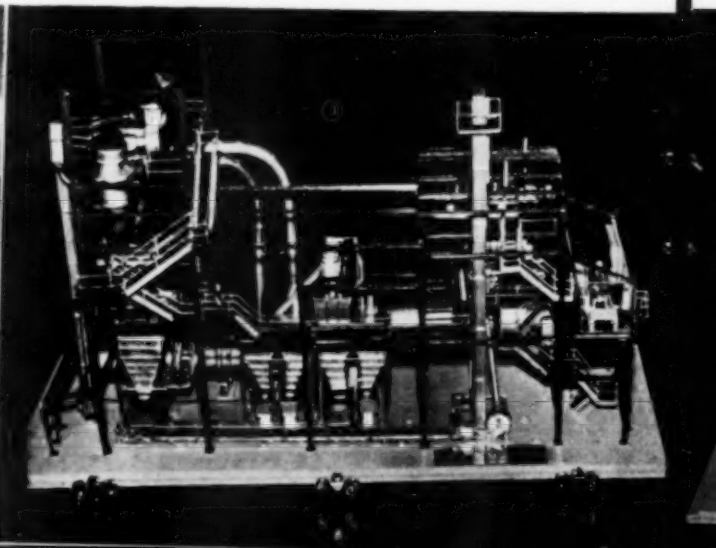
The flow diagram is shown in Figure I. In Figure II, the warehouse on the left is dry raw material storage; in the center, the process building; and on the right, a converted airplane hangar for finished product. Normal superphosphate, triple superphosphate, potash, and inerts are fed into the elevator in the center of the warehouse, which discharges onto a conveyor that connects with the process building. The conveyor that carries the finished product to storage may also be seen between the process building and the hangar.

Figure III is a picture of a model of the process building and equipment taken from the raw material side. The four storage hoppers **(A)** near the center are for the various raw materials. The hopper **(B)** at the left end of the building is for recycle storage. Each dry material and recycle is weighed continuously with gravimetric feeders and flows onto the common conveyor belt leading to the elevator on the right. The elevator discharges onto either or both of two ten-mesh screens. The rejects from the screens pass through either or both of two crushers and back into the base of the elevator. Actually in the operation at Ark-Mo, only one screen and one crusher have been used at the same time. We feel the extra ones are not needed.

Figure IV shows the finished product side of the model. The ten-mesh mixture of dry materials flows into a TVA-type ammoniator **(C)** which can be seen on the second elevation at the left in the picture. This cylindrical vessel is 7 feet in diameter and 8 feet long. There is a 27-inch retarding ring in the center and the ammoniation takes place in the front half.

Liquids

Ammoniating solutions, anhydrous ammonia, sulfuric acid, phosphoric acid, and water are either pumped or pressured through flowmeters, and are fed into the ammoniator through spargers. When ammoniating solution, anhydrous ammonia,



*By J. Sharp**
Spencer Chemical Co.
Kansas City, Mo.

Spencer ARK-MO Plant

and water are used in the same formula, they are mixed in a pipe ahead of the ammoniating sparger. A separate sparger is used for acid.

Steam

Steam and acid are not used in the same formula, so the same sparger is used for either material.

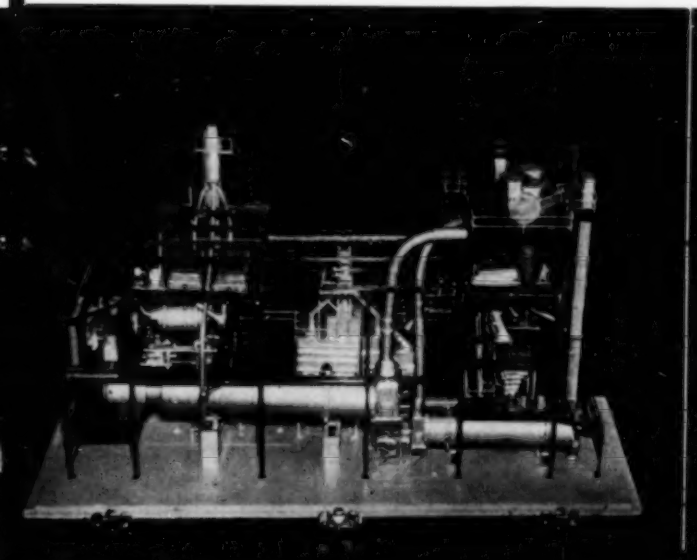
The back half of the 7 foot by 8 foot vessel is used to firm up and round off the pellets formed in the ammoniator. The product then flows into the 8 foot by 40 foot dryer. The first three feet of this cylindrical vessel contain directional flights to move the material forward. The next three feet contain no flights, and the pellets are further firmed and rounded. The remainder of the vessel is equipped with lifting flights. A vibratory conveyor carries the product from the dryer to the 7 foot by 30 foot cooler. It then flows into an elevator that lifts it to a doubledeck screen. The +6 mesh material from the top screen goes through a crusher and back into the elevator. The material that flows over the bottom screen (14 or 20 mesh, depending on grade being made) flows onto the finished product belt. The fines going through the bottom screen and dust from the dryer and cooler cyclones drop into the recycle hopper.

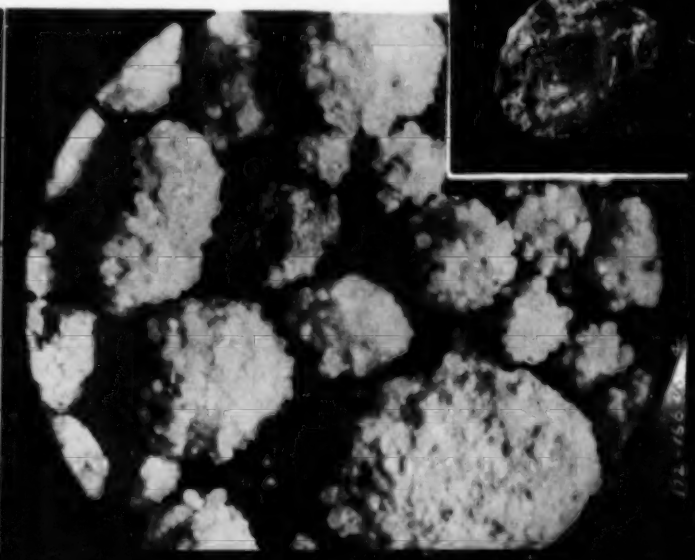
A discussion on all the grades that have been made is not contained in this article, although some 30 different formulations have been made in the Ark-Mo plant. The two grades discussed below represent extreme conditions; that is, a grade that requires a great amount of liquids to supply the nitrogen, and one that requires a small amount, namely, 14-14-14 and 3-9-27. The 14-14-14 formula has 956 pounds of liquids, whereas, the 3-9-27 has only 134 pounds of liquids. Formulas and operational data on these grades are shown in Tables 1 and 2. (See page 111, 113).

The operational data on 14-14-14 shows that 27 tons per hour of recycle at an 8 ton per hour production rate was required. This dried and cooled recycle served to absorb the liquids, and thus prevent a slurry from being formed in the ammoniator. The finished product temperature was 120° F. With greater cooling capacity, the amount of recycle could have been reduced, because temperature of the recycle greatly affects the solution phase in the ammoniator. We now recommend that the cooler be the same size as the dryer. The data also show that the cooler exit has 28.4 per cent held on a 6-mesh sieve. With the present system, much of this material is broken up to finished prod-

(*Turn to Page* 111)

*Before Fertilizer Round Table, Washington, D.C., October 11-12, 1955.





BAYER 17 147

A Promising New Insecticide

BAYER 17147, a phosphorus compound with the chemical name O,O-dimethyl s-(4-oxobenzotriazino-3-methyl) phosphorodithioate, was tested at College Station, Tex., in the laboratory and in small plots against several cotton insects during 1954. At the Conference on Cotton Insect Research and Control at Dallas (*1*), it was reported to control the boll weevil, the cotton aphid, and spider mites when applied at 1/10 to ¼ pound per acre and the bollworm at ½ pound per acre in laboratory tests; in limited field tests it controlled the pink bollworm at ¼ to ½ pound per acre, and at ½ pound per acre it had long residual action against the boll weevil. Ivy *et al.* (*2*) found it to be promising against the boll weevil, cotton aphid, spider mites, bollworm, cotton leafworm, brown cotton leafworm, flower thrips, cotton fleahopper, and pink bollworm. Robertson and Arant (*3*) reported that it had fast initial kill and long residual action against the boll weevil.

During 1955 this new insecticide was widely tested in large-scale experiments against several cotton insects, but particularly the boll weevil and the pink bollworm, at several of the field laboratories of the Entomology Research Branch, U.S.D.A., in cooperation with the agricultural experiment stations in Texas, Mississippi, and South Carolina.

The material was applied in emulsion sprays and dusts at dosages from approximately ¼ to 1 pound per acre. Applications were made at 5- to 7-day intervals. Climatic conditions were variable, but in general they provided optimum conditions for insect development and subjected the insecticide to critical tests. The Louisiana experiments were of particular interest because they were conducted in an area where the boll weevil has apparently developed a resistance to chlorinated hydrocarbon insecticides.

At Brownsville, Tex., under extremely high boll weevil and pink bollworm infestations, 10 weekly applications of a 5-percent dust held the average pink bollworm seasonal infestation to 1.3 percent of infested bolls, with 0.02 larvae per boll, in comparison with 53.2 percent of infested bolls, with 1.4 larvae per boll in the adjacent check area, and the boll weevil infestation to 14.6 percent of punctured squares as compared with 90.6 percent in the check. The treated plot yielded 2702 pounds of seed cotton per acre as compared with 668 pounds in the check—an increase of 2043 pounds per acre. Even this does not tell the whole story, because the 668 pounds that the check produced was of very low quality, with little commercial value, whereas that produced in the treated area was of high quality. (See pictures on front cover.)

Three experiments were conducted in the Brazos River bottom near College Station, two on nonirrigated and one on irrigated cotton. When applied as an emulsion spray to 0.1-acre plots, Bayer 17147 was highly effective against the pink bollworm, the boll weevil, the bollworm, aphids, and spider mites, and the yield was 450 pounds per acre more than in the untreated check areas, where it was 1867 pounds.

At Waco, experiments were conducted on several 0.1-acre plots and one 5-acre plot. In the small plots Bayer 17147 gave outstanding boll weevil control when applied in a dust or spray at ¼ and ¾ pound per acre. Aphid and spider mite infestations did not develop, but bollworms increased over the untreated check. For dual boll weevil-bollworm control a combination of Bayer 17147 and DDT is therefore more practical and economical than a high dosage of Bayer 17147 alone.

The large-scale experiment at Waco was conducted in a field of late cotton treated under usual grower procedures. The initial boll weevil infestation was 36 percent of punctured squares. Dieldrin-DDT and Bayer 17147-DDT were compared with an untreated check. The treated areas were approximately 5 acres, and the check was 1 acre. Nine applications were made to this field between July 20 and September 2. The average percent of punctured squares during the period of treatment was 39 in the dieldrin plot, 41 in the Bayer 17147 plot, and 89 in the check, and the respective yields of seed cotton were 2250, 2415, and 261 pounds per acre.

At Tallulah, La., in an area where the boll weevil was extremely difficult to control with the chlorinated hydrocarbon insecticides, Bayer 17147 was tested as a spray at ½ pound, and as 2.5- and 5-percent dusts at 17 pounds per acre. It gave significantly better control than the chlorinated hydrocarbons included for comparison. Aphids and spider mites did not build up to injurious numbers, but the bollworm was not satisfactorily controlled with these dosages.

At Stoneville, Miss., Bayer 17147 applied at the rate of ½ pound per acre in a dust or spray gave outstanding boll weevil control. After seven applications at 5-

day intervals the percent of punctured squares was 36 in the 17147 plots, 84 in the plots treated with a recommended chlorinated hydrocarbon, and 92 percent in the check. The yields in the respective plots were 1715, 1537, and 1113 pounds per acre.

At Florence, S.C., Bayer 17147 gave significantly better boll weevil control than standard recommended insecticides. In a small-plot test eight applications of a 2.5-percent Bayer 17147 dust gave boll weevil control equal to ten applications of one recommmended chlorinated hydrocarbon and eleven applications of another.

These experiments show clearly that Bayer 17147 is a superior insecticide for boll weevil control. At ¼ to ½ pound per acre in a dust or spray it consistently gave better control than any of the currently recommended insecticides, and spider mites and aphids were held below a point of injury. The bollworm was not satisfactorily controlled at these dosages, however, indicating that a combination of Bayer 17147 and DDT might be a practical solution to the simultaneous control of the boll weevil, bollworm, cotton aphid, and spides mites. Against the pink bollworm ½ to ¾ pound per acre gave better control than the recommended dosage of DDT. Since these insects along with the cotton leafworm, brown cotton leafworm, cotton fleahopper, and thrips, as reported by Ivy *et al.* (2), are controlled by this insecticide, one must conclude that it appears very promising for the control of cotton insects.

An insecticide cannot be recommended for use on cotton or any other crop simply because it will kill insects. It must be safe for the operator to apply, and it must not leave a harmful residue in or on any part of the crop used for food or feed. How does Bayer 17147 rate in these respects?

Let us first consider the hazard to the person applying or otherwise coming in contact with it. This compound belongs to a group of organic phosphorus compounds that inhibit the action of the vital nerve enzyme cholinesterase. However, available information indicates that it is no more dangerous than certain other phosphorus insecticides that are currently recommended (parathion and TEPP are examples), and can therefore be safely used if proper precautions are followed. In working with phosphorus insecticides of this group, however, one should never forget that careless use without observing all necessary precautions could lead to serious illness or death. Too much emphasis cannot be placed on taking adequate precautions in handling compounds such as Bayer 17147.

The residue problem is in a state of uncertainty at the moment, but research is going forward rapidly in an attempt to clarify it. A chemical method is under investigation by the Entomology Research Branch which may permit the determination of residues in cotton products at levels below 1 ppm. Work is also under way to develop a bioassay method for detecting toxic residues in the cotton products. Whether the insecticide can be registered for use on cotton depends on getting data showing that no harmful residues will result from its use.

A final word concerning the probable cost of the insecticide. Regardless of its effectiveness in controlling cotton insects, it must be reasonable enough in cost for the farmer to realize a profit with its use. Present indications are that it is going to be rather expensive—considerably more so on a per-acre basis than any currently recommended insecticide. However, because of its long residual action Bayer 17147 may do just as good a job when applied at weekly intervals as the other insecticides do at 5-day intervals. Aphids and spider mites would probably not be a problem following its use. Further research is needed to determine fully the advantages and disadvantages of Bayer 17147 in comparison with currently employed insecticides. If it can be cleared for

(*Continued on Page* 107)

for

COTTON INSECT CONTROL

By C. F. Rainwater
Entomology Research Branch, Agr. Res. Serv., U.S.D.A.

TEMPERATURE & MOISTURE Relationships in Granulation

By Rodger C. Smith*
Eastern States Farmers' Exchange, Inc.
West Springfield, Massachusetts

THE search for some method of effectively reducing the problem of mechanical condition or bag set has been a long one. Of the many techniques and additives which have made their contribution to fertilizer manufacturing, the method known as granulation is now generally regarded as a practical and economical way of accomplishing good mechanical condition.

Within recent years, when those of us at Eastern States Farmers' Exchange, and other organizations began working on granulation techniques, there occurred serious questions on whether or not it was a practical answer to the problem of bag set. Virtually the only method of granulation being practiced was that used in an increasing number of European mixed fertilizer plants whereby mixed fertilizer is removed from the storage pile, placed in a batch mixer with sufficient water to accomplish agglomeration, and then discharged to a granulator . . . from which the material passes to drying and cooling facilities. Approximately 15-18% moisture is necessary to accomplish agglomeration with that method. Obviously, the important matter of cost causes serious objections to that method. Each step in that process represents additional capital and operating costs. Other objections are apparent.

Fortunately, when Eastern States and others in the United States commenced study of granulation, there was some basic work completed on the properties of common fertilizer materials, the ammoniation of superphosphates, and some of the factors important to granulation. Work had been done principally by W. H. Ross, J. H. Hardesty and their associates in the U.S. Bureau of Plant Industry, which is referred to in part in this article. At that time, ammoniation of superphosphate was common, and the studies by John Hardesty and others suggested the extent to which ammonia could be reacted with superphosphates of various concentrations and physical properties. Data was available on the heat resulting from the ammoniation reactions. Solubility of salts commonly used as fertilizer ingredients had been determined. This information led to the gradual recognition that use of ammonia as anhydrous or in nitrogen solutions not only could reduce the cost of nitrogen in the mixture, but would contribute to granulation in the following ways:

(1) Use of sufficiently high amounts of ammonia in the mixture increases the temperature of the batch substantially, and according to a fairly definite ratio.

(2) Large amounts of the salts contained in the mixture of ingredients are dissolved at the temperatures attainable through high ammoniation. These salts dissolved in the free water increase the solution phase of the mixture.

(3) Ammonium nitrate and urea are the most soluble of salts used commonly in mixed fertilizers. They have also the greatest increases in solubility with increases in temperature, which is of particular importance.

(4) During the drying and cooling steps, low moisture content and large amounts of salts in solution contribute to rapid crystallization of salts and, therefore, permanency of the granules formed during agglomeration.

From this very brief review, it is apparent that temperature and moisture relationships are extremely important considerations in granulation. They can be regarded as the keys to granulation, although much of our effort has necessarily concerned equipment to accomplish the several steps in granulation. Very appropriately, much of this conference concerns suitable equipment. In summarizing some of the temperature and moisture relationships, let us begin first with formulation

*Presented at the Fertilizer Industry Round Table, Washington, D.C. October 11-12, 1955.

and then consider the steps in the process individually.

Formulation

GRADES which are generally being granulated, contain 5% or more nitrogen. Granulation is facilitated directly with increasing nitrogen content, which in turn is directly related to the amount of the more soluble nitrogen salts contained. The relative solubilities in water at 68° F. of some common fertilizers are as follows:

	Weight Per Cent
Ammonium Nitrate	66.0
Calcium Nitrate, Anhydrous	56.4
Urea	52.0
Sodium Nitrate	46.7
Ammonium Sulfate	42.8
Diammonium Phosphate	40.8
Mono-ammonium Phosphate	27.2
Ammonium Chloride	27.1
Potassium Nitrate	24.0

(Crittendon: Allied Chemical and Dye Corporation)

As this table indicates, ammonium nitrate is the most water soluble fertilizer material, with urea high on this list. It is of importance, also, that the solubility of these two materials increases substantially with increase in temperature. Mono-ammonium phosphate and potassium nitrate respond similarly through a lower temperature range. With increases from 32° to 212° F., ammonium nitrate increases in percent solubility by weight from 54 to 89% and urea from 39 to 87%.

Eastern States Farmers' Exchange has used ammonium nitrate—ammonia solutions in granulation, with only limited experience with urea-ammonia solutions. Our observation indicates that smaller granules are formed with the urea-ammonia solutions. Attempts to formulate, using both ammonium nitrate and urea, have been discouraging in that the proportion of desirable granules has been reduced substantially.

The volume of the liquid phase depends upon the ingredients used, the concentration of the mixture and, as indicated above, the temperature of the fertilizer. Hardesty has reported that the heat developed when superphosphates are treated with 6 pounds of anhydrous liquid ammonia per 20 pound unit of P_2O_5 is equivalent to 1426 BTU per pound of ammonia absorbed for ordinary superphosphate, and 1589 BTU for triple superphosphate. Their work indicates that the heat evolved per unit of ammonia absorbed decreases somewhat with the degree of ammoniation. Their work further indicates that a variation in the moisture content of a superphosphate, from 3-15%, has little or no effect on the heat developed in its ammoniation. More recent work reported by Kumagai, Rapp and Hardesty, with controlled maximum temperatures of reaction from 122° F. - 190° F. and using 7 pounds ammonia per unit P_2O_5 in normal superphosphate, had negligible effect on percent of added ammonia absorbed. On the other hand, an increase in controlled maximum of reaction (from 149-216° F.) using 5 pounds ammonia per unit of P_2O_5 in triple superphosphate, increased the percent of added ammonia absorbed from 79.1% to 89.6%

It is our experience, and I believe that of others employing high ammoniation practices in batch mixers, that about 2.5 pounds NH_3 can be reacted with 1 unit P_2O_5 in triple superphosphate; and 6.0 - 7.0 pounds NH_3 can be reacted with 1 unit P_2O_5 in ordinary superphosphate. These rates of ammoniation suggest that essentially the following reactions occur when both triple superphosphate and ordinary superphosphate are present.

$$Ca(H_2PO_4)_2 \cdot H_2O + NH_3 \rightarrow CaHPO_4 + NH_4H_2PO_4 + H_2O$$

$$NH_4H_2PO_4 + CaSO_4 + NH_3 \rightarrow CaHPO_4 + (NH_4)_2SO_4$$

Use of nitrogen solutions in quantities to attain the above rates of ammoniation has resulted in mixer temperatures of about 160° F. with 5% nitrogen grades, and nearly 200° F. with 8 to 10% nitrogen grades. Higher temperatures in the mixer are desirable to increase the quantity of salts in solution. Common methods of providing additional heat are:

1. Reaction of either sulfuric or phosphoric acids with additional ammonia.
2. Addition of steam.
3. Addition of hot water.

Of these three methods, the inclusion of either sulfuric acid or phosphoric acid appears to be the most satisfactory. The cost of acid is approximately offset by use of additional nitrogen solutions or anhydrous ammonia as source of nitrogen in the formula, as compared with the cost of an equal amount of nitrogen in dry form. One pound of ammonia reacts with approximately three pounds of 100% equivalent acid, according to the following reactions:

$$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$$

$$NH_3 + H_3PO_4 \rightarrow NH_4H_2PO_4$$

$$NH_4H_2PO_4 + NH_3 \rightarrow (NH_4)_2HPO_4$$

Heat is developed, apparently, as a result of both the heat of reaction and heat of dilution. Hardesty and Ross have reported the heat developed in the neutralization of $H_3PO_4(2OH_2O)$ with NH_3 (liq.) to

- Temperature and Moisture
- Relations are extremely important
- considerations in granulation of fertili-
- zer. Ammonia content, salt solubility, crystal-
- lization, uniformity of granular prod-
- uct, production economics, are
- among factors affected.

form $(NH_4)_2HPO4$ $(2OH_2O)$, to be 32,010 gram-calories.

With the use of either of these acids with anhydrous ammonia or a suitable nitrogen solution, temperatures of approximately 212° F. in the mixer can be attained. The evaporation of some moisture from the mix deters further rise in temperature.

Factors which contribute to high content of liquid phase can be summarized.

1. High analysis grades.
2. Ratios high in nitrogen.
3. Formulation with Ammonium Nitrate or Urea.
4. High ammoniation.
5. Reaction of an acid with additional ammonia.
6. Addition of steam or water as necessary, particularly in low analysis or low nitrogen grades.

Taking advantage of these factors in particular, it is possible to granulate at input moisture contents of approximately 6% with 8 or 10% nitrogen grades, and approximately 12% with 5 or 6% nitrogen grades. A balance between the amount of ammonium nitrate or urea, the moisture content and the temperature in the mixer is important. This balance will vary according to grade, equipment and sources of materials. As to materials other than nitrogen, let me state briefly that sources of superphosphates and muriate of potash or the use of sulfate of potash to replace muriate of potash do affect the balance between moisture and temperature necessary.

The composite of all materials introduced into the mixer determines largely the temperature and moisture relationships which occur, and the quality of granulation. However, construction and characteristics of equipment do have their effect on temperature and moisture, and the quality of granulation attained.

Granulator

IT is important to provide conditions which encourage agglomeration at the stage in the process when the temperature and moisture levels for a given formula encourage rapid crystallization and hydration. With formulas of high soluble salt content and low moisture discharge from the mixer at high temperature, granulation can be attained immediately following discharge from the mixer. With formulas of relatively low soluble salt content, and necessarily high moisture content, agglomeration is more gradual and related to the reduction of moisture content. Agglomeration may occur in a so-called granulator, the dryer or the cooler, depending upon the formula of the mixture and the characteristics of the equipment used.

A granulator essentially provides agitation or tumbling of the fertilizer during temperature reduction. A thin layer of material is important, the rate of production not exceeding 1000 pounds per square foot per hour of effective granulator surface. Either a rotary cylinder or mechanism providing horizontally vibrating surface can be used.

Dryer

A DRYER installation should attempt to accomplish at least the following:

1. Moisture reduction of the fertilizer.
2. Low fertilizer discharge temperature.
3. Maintain or increase agglomeration.

The quantity of heat, the volume of air and the direction of air flow principally determine moisture and temperature relationships in the dryer and affect agglomeration. Diameter and length of dryer and construction of flights also affect agglomeration. Temperature of the fertilizer must be maintained or increased to sufficiently high temperatures to evaporate water. Application of excessive heat can reduce the moisture content more than necessary, and result in unnecessarily high ex-dryer fertilizer temperature. Adequate volume of air is required to convey the evaporated moisture. Too large air volume can reduce drying efficiency, requiring excessive consumption of fuel. The fact that the discharge temperature of the fertilizer is sometimes less than the temperature of the fertilizer entering the dryer, leads to the occasional statement that fertilizer dryers are actually coolers.

These relationships can be illustrated by the average temperatures (see table below) on several weeks production of an 8% nitrogen grade at an Eastern States plant. Fertilizer exdryer temperatures, fertilizer ex-cooler temperatures and fertilizer ex-cooler moistures are summarized according to air ex-dryer temperatures.

If 2% moisture is assumed to be satisfactory, it can be concluded from this data that with this grade, an air ex-dryer temperature of about 200° F. is adequate in this particular dryer and with the given air volume. Higher ex-dryer air temperatures would increase both the fertilizer ex-dryer and ex-cooler temperatures.

A large dryer with substantial range of air volume and heat input offers advantages. Temperature and moisture conditions and mechanical features can be adjusted more satisfactorily in a large dryer to accomplish considerable agglomeration, the required drying and the partial cooling within the dryer. Co-current air flow is generally employed and assumed in this discussion.

Counter air flow in a dryer permits attaining lower moisture con-

(*Turn to Page* 121)

Air Ex-dryer	Fertilizer Ex-dryer	Fertilizer Ex-cooler	Moisture Ex-cooler
231-240°F	197°F	146°F	0.94%
221-230	187	140	1.27
211-220	191	144	1.59
201-210	172	139	1.66
191-200	175	134	1.77
181-190	161	125	2.21

FUNGICIDES and the Miller Pesticides Chemicals Law

*By W. B. Rankin**
Food and Drug Administration
Washington, D. C.

*From a talk before the American Phytopathological Society of America, Dec. 28-30, Atlanta, Ga.

THE Miller pesticide chemicals amendment to the Food Drug and Cosmetic Act will become fully effective for all fungicides next July. It already is effective for many of them, but there are extensions of the effective date for others.

Under this amendment all fungicides will fall into one of four classes:

1. Chemicals that are not considered poisonous as used on crops. Sulfur, lime sulfur, and the sodium and potassium analogues of lime sulfur are in this group.

2. Chemicals that are considered poisonous, but are used in agriculture so that their residues do not present any foreseeable hazard to man. These may be exempted from the requirement of a tolerance. Most of the common copper compounds have been exempted when they are used on growing crops before harvest. They are not exempted when applied at time of or after harvest.

3. Fungicides that are poisonous, but still are safe enough for small residues to remain in or on food without endangering the public health. Tolerances higher than zero are set for them on specific crops. Such tolerances have been set for:

Captan
Dinitro-O-cyclohexylphenol
Several of the dithiocarbamates
Ferbam
Maneb
Zineb
Ziram
(And since Nabam is mixed with a zinc salt before use, forming Zineb, the tolerance for Zineb permits Nabam to be used too).
Glyodin
Phygon

4. Chemicals that have a zero tolerance or its equivalent. Any compound not covered in one of the first three groups will have the equivalent of a zero tolerance when the law becomes fully effective. As a result of the 1950 spray residue hearings we found that

Dinitro-O-cresol
Dinitro-O-sec-butylphenol and
Mercury containing compounds

are so toxic that if they are used, they should be used so that no residues remain at harvest.

Other fungicides in this fourth group have the equivalent of a zero tolerance because no higher tolerance has been established for them, and they have not been exempted from the requirement of a tolerance. These compounds are:

Antibiotics for use on plants
Formaldehyde
Isothiocyanates
Quaternary ammonium compounds
Spergon
Sodium pentachlorophenate
Thiram

Chemicals with zero tolerances may be used under proper conditions that leave no residues. Many of them are being used. Formaldehyde, spergon, and thiram are used for seed treatment. Broad spectrum antibiotics are used early in the season to control fungus diseases where the time between application and harvest is enough to guarantee their complete removal from the plant.

There is another group of fungicides for which the effective date of the law has been extended. Diphenyl and O-phenylphenol are in this group. A petition already has been filed for O-phenylphenol, and we understand that a petition will be filed for a tolerance for diphenyl. These chemicals will be in one of the first four groups when the petitions are processed.

WHERE does this leave the plant pathologist who must recommend fungicides for use on crops during the 1956 growing season? In answering this question it will be wise to review recent developments in pesticide regulation: In 1947 the Federal Insecticide, Fungicide

(*Continued on Page* 101)

Sulfur-Sulfuric Acid

View of sulfuric acid production unit at The Davison Chemical Co.'s triple superphosphate plant near Bartow, Fla. Acid unit is said by its designers, Monsanto Chemical Co., to be largest in world — daily rated capacity 550 tons of 100% sulfuric acid.

SULFUR occupies a pre-eminent place in agriculture: it is an indispensable plant nutrient; a valuable fungicide; and a chemical raw material necessary in the manufacture of the largest world-wide single commercial fertilizer—superphosphate—and such other plant-nutrient carriers as the sulfates of ammonia, potash, calcium, copper, manganese, zinc, magnesium, and cobalt. For more than a century, sulfur-containing fertilizers have been used increasingly in agriculture; the history of the sulfur industry, therefore, parallels that of commercial plant food. Agriculture is the largest consumer of sulfur; in fact, consumption of sulfur by agriculture reflects the economic position of the farm community. Industry consumes sulfur in the form of sulfuric acid and not as the element. Approximately one third of the total production of sulfuric acid in this country—about 5 million tons (100 per cent basis)—is used in the manufacture of commercial fertilizers.

Historical Review

EARLY in the 19th century Justus von Liebig in Germany was able to prove, on the basis of careful studies, that plant life feeds on mineral substances and not, as was held by many up to that time, upon the organic material of manure and similar matter in the soil. He further showed that phosphorous from bones would be more quickly accessible to plant roots if the bones were first treated with sulfuric acid. This discovery led Sir John Lawes in England to treat mineral phosphates, such as coprolites, with sulfuric acid. He succeeded in getting similarly favorable results on plant growth with these acid-treated mineral phosphates. By commercializing this knowledge, Lawes laid the foundation of today's vast rock phosphate-superphosphate world industry. The growth of this industry was given impetus by the discovery of high-grade phosphates in South Carolina shortly after the Civil War, and it continued its remarkable development with successive discoveries of rock phosphate deposits in Florida, Tennessee, the Pacific Islands, North Africa, and the Rocky Mountains. In 1953, the world produced about 24.5 million tons of superphosphate (20 per cent basis), of which the United States produced about 9 million tons.

To convert rock phosphate to 18 to 20 per cent superphosphate requires approximately equal weights of the finely ground rock and 50° Be′ sulfuric acid. The process is economical and efficient, and for more than a century has been able to hold its predominant position in the trade against all competitors. Thus fertilizer practices have linked sulfur and phosphates in a close bond throughout this long period.

To make sulfuric acid, it is necessary to convert the sulfur to sulfur dioxide, further oxidize it to sulfur trioxide in the presence of a catalyst, and then cause the trioxide to react with water. The process itself is relatively simple. Sulfur for this purpose is derived either from brimstone or from a sulfide, such as iron sulfide or pyrite. Sulfuric acid has become a leader of the chemical industry, because it is a relatively low priced commodity and enters so many chemical processes.

In the early industrial period 1865 to 1890, more than half of the sulfuric acid consumed in this country was derived chiefly from Sicilian brimstone. In succeeding years, new processes were developed, utilizing sulfur from pyrites, so that from 1890 to 1915 pyrites gradually, through lower prices, supplanted brimstone. The monopolistic-minded Sicilian sulfur interests had kept brimstone prices high above what the market was willing to pay. The first World War created so strong a demand for more and higher-quality sulfuric acid that the swing started back to brimstone. By 1919, the total amount of acid derived from brimstone had increased to almost 50 percent. Meanwhile, Herman Frasch developed his process for getting sulfur out of the salt domes of Louisiana. This development restored brimstone sulfur to its premier position as the source of world sulfur in the manufacture of sulfuric acid.

Today, in the United States alone, about 10 million tons of 100 per cent acid is made from brimstone, 1.3 million tons from pyrites, and about 1.5 million tons from other sources, mostly smelter gases. Two processes dominate the sulfuric acid industry: the chamber, and the contact (tables 1 and 2).

By Vincent Sauchelli
Davison Chemical Co.
Baltimore, Maryland

in the American Fertilizer Industry

Chamber Acid

THE earlier process and the one which kept its dominant position until the turn of the century, was the chamber. In this process, sulfur dioxide is led up from burners into acid through the packing of a tower where, meeting counter-current a trickling stream of dilute sulfuric acid containing nitrous oxide, it is oxidized to sulfur trioxide. From this tower the trioxide goes into large lead lined chambers (which give the process its name), where reacting with fine sprays of water, it forms hydrogen sulfate or sulfuric acid, which collects on the floor. The acid so formed is relatively weak—about 62 to 70 per cent strength, which corresponds to 50° to 55° Be′ acid—and contains some impurities objectionable to the chemical industry.

Contact Process

THE chemical industry generally, however, had to have stronger and purer acid than the chamber quality, and its demand stimulated interest in contact processes. The first contact acid plants were relatively high in investment cost and rather difficult to operate. Their ability to compete at all with existing chamber plants was due primarily to their production of acid of higher strength and quality. Before the first World War only about 20 per cent of the country's sulfuric acid plants used the contact process; the number gradually increased, until in 1954 the production of contact acid comprised about 10 million tons out of a total of some 14 million tons. Most fertilizer companies still operate their old chamber plants; but replacements with contact plants is underway. The changeover is bound to continue. In the Baltimore area, for example, Olin-Mathieson and Davison, two of the largest producers, have each converted most of their acid production to the contact process.

In the contact process the conversion of sulfur dioxide to the trioxide is accomplished directly by means of a catalyst. Originally platinum was used as the catalyst; but impurities, such as arsenic, in the gases poisoned it, making it necessary to design a unit to reduce this

TABLE 1

Location of Sulfuric Acid Plants in the United States*

	1939		1946		1955	
	Contact	Chamber	Contact	Chamber	Contact	Chamber
Alabama	2	6	2	6	4	6
Arizona	1	1	2	1	2	1
Arkansas	—	—	—	—	2	—
California	6	—	8	—	8	—
Colorado	1	—	1	—	2	—
Connecticut	1	1	1	1	1	1
Delaware	1	—	1	—	1	—
Florida	1	3	2	5	7	6
Georgia	—	13	—	15	2	14
Idaho	—	—	—	—	—	2
Illinois	5	5	7	6	10	8
Indiana	3	1	3	1	4	—
Iowa	—	—	—	—	2	—
Kansas	—	—	—	—	2	—
Kentucky	1	—	1	—	2	—
Louisiana	2	3	3	3	5	3
Maine	—	—	1	0	1	—
Maryland	2	5	2	6	3	5
Massachusetts	1	1	1	1	1	1
Michigan	1	2	2	2	4	2
Mississippi	—	3	—	3	—	2
Missouri	2	—	2	—	3	—
Montana	—	1	—	1	1	1
Nevada	—	—	—	—	1	—
New Jersey	6	5	7	5	10	2
New Mexico	—	—	—	—	1	—
New York	2	2	2	1	2	1
North Car.	—	8	1	8	1	8
Ohio	5	9	6	9	10	8
Oklahoma	2	—	2	—	2	—
Pennsylvania	10	6	10	5	9	2
Rhode Island	1	—	1	—	1	—
South Car.	—	8	—	8	1	9
Tennessee	1	4	1	3	2	3
Texas	4	1	7	1	11	1
Utah	1	—	1	—	1	—
Virginia	3	—	4	6	7	7
Washington	1	6	1	—	1	—
West Virginia	1	—	1	—	2	—
Wisconsin	2	1	1	—	3	—
Wyoming	1	—	1	—	1	—
Total	70	95	85	97	123	82

*Source: U. S. D. Commerce and Privae.

hazard. The regeneration of the poisoned catalyst required elaborate purification equipment. The subsequent use of non-poisonable vanadium catalyst overcame these shortcomings and undoubtedly was one of the factors favoring the installation of contact plants.

By the end of the first World War, the contact process had not made much progress. The plants were designed almost entirely for handling pyrites, which involved extensive gas cooling and cleaning equipment between the roasters and the acid plant. Perhaps the only big improvement made at that time was to substitute sulfur and thus eliminate the dust factor. In that period, a good chamber plant that could produce an acid of, say, 60° Be′ had the advantage in acid cost over a contact plant; whereas for 66° Be′ or stronger acid, the contact plant had the advantage.

TABLE 2

Growth of Sulfuric Acid Plants in the United States, 1915-1955*

Year	Number of Chamber Plants	Number of Contact Plants
1915	175	15
1920	178	27
1925	152	37
1930	126	46
1935	71	63
1940	96	74
1945	99	87
1955	82	123

*Source: Based on "Chemical Engineering" statistics and private.

Then in 1925 Monsanto introduced a perfected vanadium catalyst which was not affected by arsenic or chlorine, two elements that readily poisoned the platinum catalyst. This eliminated the elaborate purification facilities required with the platinum catalyst. Further improvements followed, and by the second World War, acid manufacturers had available four pass converter types of contact plants capable of converting more than 200 tons of acid a day. Today contact plants are designed, at much lower cost, capable of handling an 8 to 10 per cent sulfur dioxide with a 96.9 per cent conversion; a prewar plant rated at 150 to 160 tons a day is now capable of producing 200 tons with the addition of only a small amount of vanadium catalyst.

The contact process produces a much stronger acid than chamber acid and will not corrode iron, whereas chamber acid has to be kept in expensive lead-lined vessels. Less space is required in the contact process to produce the same amount of acid. Modern superphosphate manufacturers prefer using 56° Be′ acid (71.2 per cent H_2SO_4). Higher strength contact acid can be diluted on the spot with the evolution of heat. Taking advantage of this heat, one can obtain the proper temperature of the acid for acidulation. Chamber acid, on the other hand, must be heated to the proper acidulating temperature, especially in northern regions during winter.

Financial considerations cannot be ignored, especially in the fertilizer industry, which operates on a narrow margin of profit. At today's prices, the capital investment, raw materials, and operating costs generally favor the contact process.

Pyrites and Brimstone

THE relative position of pyrites and brimstone in the sulfuric acid industry has been suggested. Pyrites came into use when Sicilian sulfur was increased from $20 to $70 per metric ton. This sharp increase stimulated the satisfactory substitutes. In 1833, Michel Perret of France developed a process for getting sulfur dioxide from iron pyrites by roasting them at 900 to 1,000°F. Germany and other European countries quickly installed facilities. As improvements were made in the process, more units were installed, and by 1880 most European countries had completely switched to pyrites. The process did not make the same gains in the United States. Subsequently, discovery of sulfur in the salt domes of the Gulf States and the success of the Frasch process enabled brimstone to hold first rank in this country.

Brimstone has definite advantages over pyrites, primarily economic, which in the long run always determine the issue. Some comparisons will bring these out: First, only about 40 per cent of pyrites is converted to sulfur dioxide, as against 98 per cent of brimstone. Economies in freight, in fuel consumption, and in size of furnace grates favor sulfur burning. Pyrites produce an iron oxide residue which has to be handled, sintered, and nodulized to render it acceptable to the steel industry. These operations add to its shortcomings. The total cost of a pyrites roasting plant is roughly about 2.5 times that of a sulfur-burning plant. The labor and maintenance costs of the pyrites roaster plant make it relatively uneconomical. If the chamber process is used with pyrites, the consumption of nitrous oxide is about twice as high as in a brimstone plant.

The use of pyrites at present, however, is by no means negligible. It is estimated that in 1948 about 5 million tons of pyrites were consumed, of which more than 1.25 million tons were obtained in Spain. In 1954 about 395,000 tons were consumed, mostly from domestic sources. Those interested in its survival are making improvements to maintain a competitive position. For example, one of the latest developments is flash roasting. This improvement involves a flotation process for concentrating ores, resulting in a product of 100- to 200-mesh size. These fines are fed into a vertical kiln from the top, and as they drop through a counter current of air they burn completely by the time they reach the floor of the kiln.

Pyrites and brimstone have been in competition many years. Which will eventually survive and dominate is anybody's guess. Economic factors will certainly give the ultimate answer. So long as brimstone can be obtained in as pure a form and at relatively low costs as at present in Texas, Louisiana, and Mexico, and so long as new salt domes are discovered, brimstone will perhaps dominate the American sulfuric acid scene. The competition between these two sources of sulfur is a healthy factor in our chemical industry.

(*Continued on Page 125*)

North Carolina Pesticide School Emphasizes Nematode Control

W. G. Westmoreland, extension weed control specialist, A. S. Crafts, University of California, Dr. R. L. Lovvorn, North Carolina Agricultural Experiment Station director, and W. A. Harvey, California weed control.

APPROXIMATELY 200 pesticide manufacturers, dealers, formulators and agricultural workers from along the eastern coast attended the annual 1956 Pesticide School held at North Carolina State College, Raleigh, N. C., January 10 and 11. Much time and attention were concentrated on nematodes, a pest of prime importance in the area on sweet potato crops, tobacco crops, fruits, and home and market crops.

Dr. J. N. Sasser, plant pathologist in nematode research, reviewed the general nematode situation. He stressed the large volume of fumigants used for nematode control and pointed out that an estimated 231,000 acres of tobacco land were fumigated during the 1955 season in North Carolina. An additional 14,000 acres in crops other than tobacco were also fumigated against nematodes. The trend is away from the broadcast method and to row treatment, he reported.

Dr. L. W. Nielsen, plant pathologist, presented further evidence that root knot nematodes are largely responsible for much of the cracking and scabby finish of sweet potatoes. He reported a significant increase in both yield and quality when sweet potato fields were fumigated.

Extension plant pathologist J. C. Wells said that home and market gardens in North Carolina are habitually infested with root knot nematodes. In fact, he estimated losses caused by this condition at 4½ to five million dollars annually. He reported research and extension demonstration results which indicate that practically all gardens would benefit by fumigation. Extensive demonstrations on fumigation in garden soils will be conducted in 1956.

Dr. C. N. Clayton, plant pathologist in fruit disease research, blamed nematodes for much of the difficulty in establishing new peach orchards in old orchard sites or on cultivated land. He presented evidence showing the value of soil fumigation with nematocides prior to setting new orchards.

Dr. C. J. Nusbaum, plant pathologist in tobacco disease research, cited some of the difficulties in controlling nematodes in field plantings. He said that while a fumigant may be an excellent treatment for one particular nematode, at the same time it might not be adequate in controlling another. All commonly recommended fumigants seem to be about equally effective against root knot; some may give excellent control of meadow nematodes where high population exists, and others may not.

George D. Jones, extension entomologist, who gave the major changes in control recommendations for 1956, put North Carolina cotton farmers on their guard. He said that unless the State gets several days of below 15 degree weather, boll weevils may be the worst they have been since 1950. He warned that farmers should check fields early for overwintering weevils.

For vegetable insect control, Jones said that a malathion-methoxychlor mixture may become widely used this season. The Mexican bean beetle in one area shows a tolerance for rotenone, and it appears the cabbage worm may also be becoming resistant to DDT. He suggested 10 per cent toxaphene for use on both flea beetles and cabbage pests.

He also named two new pests which have been giving increasing trouble in the North Carolina area, — alfalfa weevils and a looper which attacks tobacco. The alfalfa weevil, said not to be serious at present, can be controlled with aldrin or dieldrin. The looper, believed to be the same pest as the cabbage looper, can be controlled with one of the new tobacco insecticides.

As for livestock insects, Jones said that diazinon has been approved for use in dairy barns. None of the phosphates listed can yet be used on livestock such as milk cows, hogs, and poultry. Malathion has been approved for use on dogs and cats but not on poultry for controlling lice.

G. C. Klingman, associate professor of agronomy, reported some progress in handling garlic. Five years

(*Continued on Page 93*)

Top Photo: Dr. D. E. Ellis (standing), professor of plant pathology, N. C. State College, points out something of interest in the 1956 Pesticide Manual. Looking on are Myron Maxwell of Maxwell Insecticide Co., Cary, N. C.; and Dr. C. F. Smith, head of the entomology department at N .C. State.

Bottom Photo: Shown below at the registration table are A. F. Leavitt of Apex, N. C.; W. J. Gehweiler of Guthenburg, N. J.; and Phil Arey of Orlando, Fla.

(Photos by Ralph Mills, N. C. State College.)

Natural Predators

Can Selective Insecticides Help To Preserve Biotic Control?

By B. R. Bartlett

Department of Biological Control
University of California Citrus Experiment Station
Riverside, California

IT is generally recognized that many of the recently developed potent contact insecticides provoke increases of other pests by destroying their natural enemies. Because of the spectacular nature of these upsets, they have been highly publicized. Of greater concern to entomologists is the fact that destruction of natural enemies may cause the pest for which control was applied to flare back with extraordinary rapidity, after initial suppression by the pesticide.

Where the outbreak of an entirely different pest has occurred from application of a pesticide, it has been a common practice to attempt to counteract the new pest problem by the addition of another chemical to the original formulation. To inhibit pest flarebacks, the common practice has been to substitute materials having more persistent residues, in attempts to get more lasting control. Both of these procedures have tended to bypass the basic cause of the troubles, namely, the destruction of natural enemies. Because of the inability of these commonly used methods to correct the fundamental difficulties, there has been considerable pessimistic speculation concerning the present-day trends in pest control. Extremists even have contended that over-all pest control efficiency is regressing, with increased reliance upon the new materials. Although this strong condemnation is unwarranted, it has served to stimulate studies in a number of entomological centers, both domestic and foreign — studies directed toward a better understanding of the interactions of chemicals and natural enemies in pest control.

Considerable progress has been made in these studies on integration of chemical and natural control programs. The achievements in Nova Scotia have been particularly outstanding. There, A. D. Pickett and his co-workers (See *Agricultural Chemicals*, June 1955) have developed a limited but well-integrated pest control schedule for all the pests of an apple-orchard area. This schedule advantageously utilizes natural enemies in a near-full capacity to restrain pest resurgence after treatment, as well as to complete the destruction of pests not killed by the chemicals applied. The practicability of the program developed to solve the apple pest problem in Nova Scotia has demonstrated that it is possible, in this case at least, to reverse the trend toward ever-increasing pesticide treatments by a judicious use of materials. In England, work along comparable lines has been particularly well supported. There, chemical control programs harmonious with natural control forces are receiving the greatest consideration. In the United States, there is a similar trend. Entomologists engaged in the study of field problems are becoming increasingly aware that the lasting effectiveness of pesticidal treatments often is dependent not so much upon initial kill of the pest as upon the restraint imposed by natural enemies upon subsequent build-up of the pest.

Expectations once were that increased initial toxicity would necessarily lead to increased lasting qualities of pest control. This time-honored concept now must be challenged. In an increasing number of cases, relatively inefficient toxicants surprisingly give better long-range pest control than do those of higher initial toxicity. The immediate reaction to these anomalous conditions is generally to call upon industry to produce more selective toxicants, with little thought as to what is involved in selective toxicity, particularly from the standpoint of the industry being charged with the research and development of such a product.

Some field entomologists feel that it is just a matter of time until the development of systemic insecticides will supply an abundance of insecticide materials which may be applied through the plant roots or in other ways in which no contact activity is exercised directly against natural enemies. Unfortunately, up to the present time, systemics have appeared applicable only to the solution of a small segment of pest problems, principally those represented by certain sucking insects and mites.

In addition to the possibilities offered by systemic insecticides, there

is a strong probability that the utilization of insect pathogens, such as viruses, bacteria, and fungi, will make available additional products that will be perfectly harmonious to natural enemies. Outstanding developments from both systemics and insect pathogens may in truth come to pass more quickly than generally realized, since studies in these fields are progressing rapidly on a world-wide scale. However, they will not completely replace the standard contact, stomach, and fumigant toxicants. These undoubtedly will always play a major role in pest suppression. In the meantime, it is important that the correct use of currently developed products be established so that they will accomplish the purpose for which they were intended, namely, long-lasting pest control.

In the Department of Biological Control of the University of California, considerable attention has been devoted to an investigation of commercially available insecticides, with regard to their selective toxicity to natural enemies. The interest has been twofold: first, to develop insecticidal check methods, by means of which we can assess the individual value of certain parasites and predators in pest suppression; and, secondly, to assist in the development of field programs, which will best preserve those natural enemies that warrant protection.

Greater information on the value of individual parasite and predator species in checking pest increases is basic to any future progress in the development of integrated chemical and natural control programs. Accurate field evaluation of natural enemy effectiveness has been greatly neglected in the past. As a result, there is, in general, little information concerning which natural enemies warrant protection, and which ones may be ignored. Formerly, studies on natural enemy evaluation were based almost entirely upon correlations of the fluctuations in the field of pest and natural enemy abundance. With these methods, the effectiveness of natural enemies working at high population densities could be assessed fairly well, but what was probably more important, the restraining influence of natural enemies upon early build-up of the pests could not be determined accurately. It was only with the advent of the new powerful contact insecticides that a truly satisfactory technique became available for assessing the over-all effectiveness of individual species or groups of species in suppression of certain pests. This method consists of destroying the natural enemies in the field by the use of selective insecticides, which do not effect destruction of the pest. The subsequent pest increase in the absence of the natural enemies indicates the effectiveness of the natural enemies. This insecticidal check method is rapidly replacing the old, inefficient correlation and sleeve-cage techniques of analyzing natural enemy effectiveness.

Field programs designed to preserve valuable natural enemies are being conducted in many entomological centers of the world. In most instances, these studies follow well-defined paths. They ordinarily start with situations in nature in which no chemicals have been applied, so that the effectiveness of natural enemies may be assessed, while the pests and natural enemies are in natural balance. Results from these initial studies have oftentimes been surprising. In a number of instances, complete abandonment of complicated pest control practices has resulted in the restoration of a natural balance, whereby certain pests may be held under economic control by natural enemies, alone, for long periods of time. These striking results have gained wide publicity, and have fired the imaginations of entomologists. It has generally been recognized, however, that a favorable balance can rarely be maintained over extended periods, without at least some chemical control treatments. Furthermore, a period of exceptionally high pest density usually follows cessation of treatment, and precedes the establishment of a favorable natural balance.

Many entomologists are busily engaged today in attempts to lessen the difficulties in establishing and maintaining these favorable balances, particularly by techniques involving a sparing but judicious use of chemicals. Gradual substitution of less noxious chemicals for those now employed, skip-and-spot treatments to preserve natural enemy reservoirs, liberation of insectary-reared parasites and predators, provision of untreated non-economic host plants for the pests which preserve natural enemy reservoirs, and emphasis upon treatments timed to avoid periods of natural enemy activity or timed to preserve protected stages of natural enemies are but a few of the measures by which entomologists hope to overcome the difficulties encountered, when integrated pest control treatments are attempted.

Selectivity of Pesticides

IN the course of the studies designed to reverse the trend toward ever-increasing pesticide demands, some of the general concepts of integrated programs have appeared to justify special attention by those connected with the research and development of pesticides. Such generalizations are necessarily fragmentary and not without exceptions, but may be of some help in defining future emphasis in pesticide development.

Stomach Poisons

Stomach poisons offer great opportunities for use in integrated chemical and natural control programs. With few exceptions, predators are ordinarily protected from stomach poison activity because of their feeding habits. Accidental ingestion by some of the chewing predators may occasionally cause their destruction, but those which feed upon body fluids and internal tissues of their hosts are normally protected. Similarly with parasites, except for occasional contamination of honeydews upon which the adults may feed, there is little or no detrimental effect from stomach poisons. Pest control through the use of stomach poisons often establishes an advantage to internal parasites, since attack by an internal parasite commonly stops or slackens further feeding by the host, while unparasitized hosts continue feeding until killed by the toxicant. This results in

earlier dominance by the parasite, as well as better parasite reservoirs to check pest resurgence.

Whereas stomach poisons once were considered to be even more deleterious to natural enemies than some of the contact poisons having very short residue retention, the picture today is exactly reversed. The new contact poisons, with their general toxicity, are more indiscriminate in their toxicity than are many of the old-line stomach poisons. Stomach poisons are, of course, restricted in their use to chewing insect pests, and it is unfortunately true that many of today's most serious pests are the sucking insects, which are not subject to this type of control.

Contact Insecticides

Contact insecticides, with persistent residues, are the chief offenders in the destruction of natural enemies. Transitory residues permit earlier reentry of natural enemies from outside areas, and permit greater survival of the internal parasites, protected as they are as immature stages in the body of their host.

It is significant that a number of the organic phosphates with short residue retention, despite their very general toxicity, have so rarely provoked pest upsets. Even parathion and malathion, particularly when used at lowered dosages, occasionally permit some survival of internal parasites. Although this is generally only the case with low dosage applications, it does provide some criterion for estimating the period of residue persistence desirable for preserving reservoirs of internal parasites in a treated area. Since many internal parasites have a developmental period for the immature stages of approximately 15 to 20 days under optimum summer conditions, this period, or less, of toxic residue persistence should ordinarily be expected to permit them to emerge into a residue-free environment. This period of immature development is materially lengthened with cooler temperatures.

Ovicides

Ovicides represent a largely unexplored field of entomological research, which in the future may well produce effective pesticides of outstanding selectivity. Dormant treatment on deciduous crops represents a type of control generally causing little disruption of natural enemy populations, owing to the limited natural enemy activity during that period. Both petroleum and tar oils have been quite thoroughly investigated with respect to selective penetration of insect eggs, but the search for new and better ovicides has not been explored, except in a few instances where fortification of oils has been attempted.

Acaricides

Acaricides have been responsible for stimulating much interest in selective insecticides. The fact that so many acaricides are selective is unquestionably associated with peculiarities in the physiology of spider mites that distinguish them from insects. These often obscure differences are probably, in many cases, not so great as are differences that exist between insect groups, but the economic pressure for effective acaricides has stimulated research in this field. The fact that acaricides show a most interesting selectivity even among plant-feeding mites is evidence, not only that the various materials work in diverse ways, but also that a similar series of selective materials could be developed for any insect pest group, if satisfactory impetus were supplied.

A few acaricides have some insecticidal toxicity, which in particular cases may be so severe as to provoke pest upsets by natural enemy destruction, but there is, at present, such a satisfactory array of acaricides, that nearly any desired natural enemy situation can be preserved by judicious choice of products. Many of the insecticides have some acaricidal properties, a situation that may be responsible, in part, for one of the most curious enigmas today in natural control. Upsets in plant-feeding mites exceed all others resulting from insecticidal usage. Considerable research on the subject of flareback of spider mites, following their initial destruction by insecticides, indicates that the predatory [typhlodromid] phytoseiid mites may play a major role in spider mite increases. The degree to which physiological plant conditioning by chemicals influences these upsets, in comparison with destruction of natural enemies, has not been completely resolved.

Fungicides

The fungicides bear a particularly interesting relationship to complementary natural and chemical control. Fungicides are, of course, of special concern, where beneficial fungi are involved in pest control. Replacement of sulfur-bearing compounds, with their serious deleterious effect upon insect natural enemies and predatory mites, by the newer fungicides has, in a few cases, diminished the detrimental effect on natural enemies. A few of the newer fungicides exhibit some effects against a few delicate natural enemies—effects which appear to be not drastic, but quite selective against certain species. Serious upsets would, in general, rarely be provoked by such slight effects, though where the material is a protectant its lasting effect could, presumably, be serious. In this respect, it would appear that any slight contact insecticidal toxicity would be to the disadvantage of a fungicide, since it could only destroy the delicate species of natural enemies, without appreciable restraint upon the pests. Some stomach poison or ovicidal effect on insect pests, combined with high fungicidal activity, would probably be a more desirable combination. Fungicides leaving heavy granular residues have disadvantages, in that they sometimes favor spider mite increases. Insecticides have been found with some limited fungicidal qualities. They would rarely have any disadvantage, unless protection of beneficial fungi was desired.

Physical vs. Physiological Selectivity of Pesticides

INSECTICIDES that are selective in their toxicity to pests and natural enemies have frequently been suggested as the ultimate goal, toward which pesticide research and development should be directed. There

(*Turn to Page* 107)

Granulation

- with
- Uramon
- Ammonia
- Liquors

*By Ove A. Jenson**
E. I. du Pont de Nemours & Company, Inc., Wilmington, Delaware

COMPARATIVELY little has been done, or even attempted, using urea - ammonia - water solutions (UAL) in the granulation of complete fertilizers. Most of the process development, as well as the practice to date, has employed ammonium nitrate-ammonia-water solutions, often as the sole source of nitrogen, or supplemented with anhydrous ammonia, ammonium sulfate, sulfuric acid, or phosphoric acid.

The reasons for the lack of interest in or work with urea are probably twofold. First urea solutions have had for a considerable period, a somewhat limited production and availability, whereas the current and prospective supply situation of ammonium nitrate solutions, produced by a larger number of manufacturers and in much larger quantity, has been favorable. With the advent of new urea producers, and with more planned, this condition is rapidly changing.

A second and almost equally potent reason for the neglect of urea has been the generally held opinion that urea was not a suitable material in the granulating process, because of hydrolysis or decomposition under the high temperatures involved in the ammoniation and subsequent drying processes. The reasoning here was based on experience with urea in conventional fertilizers, in which urea is known to hydrolyze in long-continued hot storage. Since conditions are somewhat different in granulation processes, with lower moisture content of the finished product, and with cooling generally practiced, it was felt expedient to explore the behavior of urea; to ascertain if hydrolysis was a serious factor, and if so, where; and to determine the granulating characteristics of urea with respect to storage qualitites, granule hardness, and hygroscopic behavior.

This, then, is an account of tests, first in a pilot plant, and then in plant scale equipment, using Du Pont "Uramon" Ammonia Liquors A and B, hereinafter referred to as UAL-A and UAL-B. These tests were begun about a year ago, and are still continuing. They have been exploratory in nature, and no pretense is made of uncovering any new granulation technique. Most workers in the field will concede that granulation today is an art, more than a science, and that much remains to be learned.

Pilot Plant Work

IN the pilot plant tests, the equipment was essentially the same design and size as the TVA pilot plant, consisting of an ammoniator-granulator, a gas fired counter-current dryer, and accessories such as automatic feeders for dry materials and flow-rate meters or volumetric pumps for UAL, sulfuric acid, and water. Dry materials were screened to -10 mesh. Product was produced at a rate of about 1000 pounds/hour. Cooling was effected by spreading material in a thin layer with air movement provided by a fan.

Four formulas were tested, 8-16-16, 10-10-10, and 5-20-20, with all of the nitrogen from UAL-B; and a 10-10-10 with approximately 7¼ units from UAL-B and 2¾ units from ammonium sulfate. The formulas were calculated for absorption rates of 5 pounds ammonia-unit of phosphoric acid in 20% run-of-pile super, and 3 pounds/unit in 45% triple super. 60° B sulfuric acid (77% H_2SO_4) was added to neutralize the excess free ammonia, after allowing for the calculated absorption of the phosphoric acid, at the rate of 3.7 pounds 60° acid for each pound of free ammonia. In the 5-20-20, the acid was necessary only for the heat. As will be noted, the amount of sulfuric acid in the 10-10-10 with all N from UAL-B was considerable. Some variations were tried in the amount of water added. The exit temperatures from the ammoniator-granulator ranged from 150° to slightly over 200° F; and from the dryer 150° to 250° F, averaging 180° to 185° F. The through-put time was 10 minutes in the granulator, and 15 minutes in the dryer, or a total of 25 minutes.

TABLE 1

Materials and Analysis	Pounds Per Ton			
	8-16-16	10-10-10	5-20-20	10-10-10
UAL-B 45.5	335	444	220	330
R P Super 20	600	1000	540	1000
Triple Super 45	445	—	650	—
Ammonium Sulfate 20.6	—	—	—	275
Muriate of Potash 60	535	335	670	335
60° B Sulfuric Acid	170	330	25	180
	2085	2109	2105	2110

*Presented at the Fertilizer Round Table, October 10, 1955, Washington, D. C.

The formulas given on Page 45 allow for the evaporation of varying amounts of water, and would be calculated more exactly for plant-scale operation.

Samples for analysis to determine urea hydrolysis were taken from both ammoniator and dryer, and cooled to air temperature, about 85° F, as rapidly as possible by air current from a fan. One sample from the dryer was kept at 160° F for 30 minutes. Another sample was stored at 140° F for 16 hours. The hot storage samples showed no greater urea hydrolysis than the cooled samples, and in none was the hydrolysis significant, or an important factor, as indicated in the following analyses (Table 2).

In these trials the desired or permissible particle size was considered to be -4, through 4 mesh, and +20, retained in 20 mesh. The fines, -20 are normally recirculated in the granulator, although they were not in most of the grades tested here. The oversize, +4 are normally run through a crusher, recovering about ⅔ in the desired particle size. The aim is to have as few fines as possible, and likewise to have a few oversize, since large granules are difficult to dry. Satisfactory granulation and yield was achieved for all grades, but the 5-20-20 was the least satisfactory. The following figures indicate the screen analyses and yields (Table 3).

No great technical difficulties were encountered in these tests. The granules were smooth, almost spherical, and in hardness and resistance to degradation were considered quite satisfactory.

TABLE 2

ANALYSES

No.	Description	Urea Nitrogen: Nitrogen %	Urea Nitrogen: Calculated %	Urea Nitrogen: Found %	Urea Nitrogen: Recovery %
381	8-16-16 dryer 180°, cooled	8.00	3.55	3.53	00
382	8-16-16 dryer 180°, 16 hrs. 140°	7.33	3.25	3.42	105
391	8-16-16 ammoniator 185°, cooled	7.20	3.20	3.11	97
392	8-16-16 dryer 140° cooled	7.70	3.42	3.31	97
393	8-16-16 dryer 174° cooled	8.70	3.86	3.49	90
401	10-10-10 ammoniator 170° cooled	10.00	3.23*	3.37	104
402	10-10-10 dryer 195° cooled	10.55	3.23*	3.44	106
403	10-10-10 ammoniator 186° cooled	9.15	3.23*	3.47	107
404	10-10-10 dryer 180° cooled	9.60	3.23*	3.43	106
405	10-10-10 ammoniator 202° cooled	9.80	4.35	4.08	94
406	10-10-10 dryer 175° cooled	10.15	4.50	4.10	91
407	10-10-10 dryer 175° 30 min., 160°	10.25	4.55	4.26	94
411	5-20-20 ammoniator 155° cooled	5.83	2.59	2.45	95
412	5-20-20 dryer 180° cooled	7.00	3.11	2.97	96
413	5-20-20 ammoniator 155° cooled	4.85	2.15	2.10	98
414	5-20-20 dryer 180° cooled	5.20	2.31	2.23	97
415	5-20-20 dryer 150° cooled	4.93	2.19	2.13	97
416	5-20-20 ammoniator 155° cooled	4.65	2.07	1.93	93

*basis 7¼ units N from UAL-B

Plant Scale Test

FOLLOWING the pilot plant tests, a plant scale test was made in a process closely resembling the TVA process, the essential units being an ammoniator-granulator, a counter-current dryer, and a cooler. Only one formula, 6-24-12, was tried with UAL-B, as follows:

Initial pressure of UAL-B was 25-30 p.s.i. Air was applied to increase to 50 pounds, and later to 70 p.s.i. No difficulty was experienced in "flashing" in the recording rotameter. A small amount of water, varied to suit the optimum granulating conditions, was added to the above formula through a suitable flow-meter. Granulation of 6-24-12 with UAL-B was begun at an initial rate of 15 tons/hour without difficulty. However, as soon as the fines were recycled, trouble was experienced in maintaining the proper moist "plastic" conditions in the mixer, resulting in increased fines and a progressively lower and lower yield of granular product. The difficulty was corrected by temporarily suspending the recirculation of fines, and by reducing the production rate to 10 tons/hour, then gradually increasing the rate to 15 tons/hour with re-introduction of the fines. When the proper equilibrium was established, granulating proceeded satisfactorily at the normal rate.

Once "on stream," the yield of the 6-24-12 with UAL-B was considered satisfactory, as indicated by screen analyses as shown in Table 5.

TABLE 3

	Screen Analysis — % +4	−4 +10	−10 +20	−20 +35	−35	Yield* %
8-16-16 no added water	2	25	26	26	21	52
8-16-16 plus 2% water	3	43	19	24	11	64
8-16-16 plus 4% water	28	47	11	9	5	76
10-10-10 7.25 units N from UAL plus 1.7% water	19	47	10	13	11	69
10-10-10 all N from UAL plus 3.8% water	18	47	15	12	8	74
5-20-20 plus 6.7% water	1	29	23	22	25	52
5-20-20 plus 7.7% water	5	47	16	17	15	66
5-20-20 plus 9% water	11	39	19	20	11	65
5-20-20 plus 10.2% water	8	28	14	24	26	47

*Sum of (−4 +10) (−10 +20) and ½ (+4)

TABLE 4

6-24-12 — UAL-B	Lbs./Ton N	P_2O_5	K_2O	H_2O	NH_3
803 "Conc." super 48.5		388.6		8	—19
270 UAL-B 46.5	125.5			47	+85
462 R P super 20.0		92.4		42	—23
405 Muriate 60.0			243	6	
170 60°B H_2SO_4				39	—46
2110	125.5	481	243	142	—3
—110				—110	
2000				32	

(Continued on Page 117)

Role of Entomology in

By George W. Irving*
Agricultural Research Service
U. S. Department of Agriculture

TREMENDOUS progress has been made in entomology since the profession first came into being a little over a hundred years ago, and great forward steps have been taken, particularly during the past 20 to 25 years. What we are more directly concerned with at the moment, however, is the future . . . and the phases of our work which still present a continuing challenge to us.

One way to look at the job ahead is from the business man's viewpoint. This viewpoint is entirely legitimate, because entomology is big business. Losses from insects in this country, plus cost of control, amount to 4 billion dollars a year. That's big business in any man's language. It's almost equal to the nation's entire corn crop, which in 1954 was valued at 4.4. billion dollars. It has been estimated that insects take more of the production of our soils than man; that they destroy more of our forests than fires; that, if left uncontrolled, they would take at least half the average production of the U. S. acre. I'm not sure they wouldn't take all of it.

The job of reducing these losses—of saving at least some of the 4 billion dollars—rests with entomologists. The job is big now, and all signs point to its getting bigger.

These signs are apparent in every phase of agriculture, but, let's consider them one phase at a time—the growing demand for livestock products. More livestock products mean more animals. More animals require more feed and forage. That means the job of controlling livestock and forage insects will increase accordingly. It means that research entomologists must develop new, more efficient methods of insect control, and that regulatory entomologists will have to search out seats of infestation, and apply these control and eradication measures on a larger scale. This will be particularly true in the South, where livestock production is increasing rapidly, and where climatic conditions favor the build-up and spread of livestock pests.

Moreover, the need for more and better pastures and feed crops will mean more research on new types and new varieties of forage plants—better adapted to livestock production areas, that give higher yields, and have longer growing seasons. Better insect control will be a must in this over-all expansion of agriculture to meet the need for more livestock products.

Aside from grasshoppers, we know very little about the insects that destroy grasses, or about the relationships of insects to forage plant diseases. This is particularly true of range land plants, which may be affected themselves or may serve as reservoirs of diseases that attack cultivated crops. Here is an almost unexplored field of research involving millions of acres.

We have a fair idea of the damage from insects that attack forage crops above the ground, but our knowledge of soil insects is somewhat limited. The insects that damage and destroy crops from below the surface of the soil may be among the most important of all insect problems from the standpoint of increased crop production. Research in this area may very probably be the entomological frontier of our time. Cutworms, wireworms, white grubs, rootworms, and others beyond our present comprehension await entomolgical study. We've seen unexpected increases in yields resulting from the use of new soil insecticides. Control of wireworms on 60,000 acres of lima beans in California a few years ago increased yields nearly 25 million pounds, with a net increase in value of more than 4 million dollars.

It should be apparent that one of the most efficient and economical ways to control insect pests of crops is to build resistance into the plants themselves. A start has been made in this direction, and some of the preliminary results of cooperative research between entomologists and plant breeders mark this approach as extremely promising. For example, Lahontan alfalfa is quite resistant to the spotted alfalfa aphid. Although Lahontan is not widely adapted to alfalfa growing areas of the country, it does provide a promising source of resistance to be incorporated into commercial varieties. Research along this line is an open field that must be

(*Continued on Page* 102)

*Based on an address at the meeting of the Entomological Society of America, November 30, 1955, Cincinnati, Ohio.

Ennis Is President of WSA; Danielson Is Chairman of NE Branch

TECHNICAL and commercial considerations of new and old herbicide materials highlighted the charter meeting of the Weed Society of America and the 10th Annual Meeting of the Northeastern Weed Control Conference, held January 4-6, 1956 at the Hotel New Yorker, New York City. The three day session culminated with the report of the Northeastern Research Cordinating Committee, which included suggestions for 1956 recommendations.

New officers were elected at the two meetings. In the National Society, W. B. Ennis, Jr. Mississippi State College, was elected president to succeed R. H. Beatty, American Chemical Paint. Other new officers of the Weed Society of America are vice-president, A. S. Crafts, University of California; W. C. Shaw, US DA, continues as secretary-treasurer, and W. C. Jacob, University of Illinois, continues as business manager. In the Northeastern Weed Control Conference elections L. L. Danielson, Virginia Truck Experiment Station, was elected president to succeed J. D. Van Geluwe, GLF Soil Building Service; the new vice-president is C. L. Hovey, ESFE; R. J. Aldrich, Rutgers University, continues as secretary, and D. A. Schallock, Rutgers University, as treasurer.

At the opening session, B. T. Shaw, USDA, addressed the membership and guests on the subject, "Weed Control as a part of American Agriculture," advising the group that this year "public funds for research on weeds are in the neighborhood of $2 million. The chemical industry investment," he continued, "amounts to more than $10 million for research and development of pesticides including herbicide studies."

"Weeds are big business," Mr. Shaw reported, "costing the farmer some $4 billion a year, . . . that nearly equals the value of the nation's entire corn crop." We need more preliminary information on herbicides. . . volatility, relationship to temperature, moisture and light, and on the growth of crop. Further investigation of application equipment is necessary . . .more information is needed on biological control which is potentially the cheapest way of controlling weeds, plant disease and pests. A phase of weed control which is currently under investigation, and offers considerable promise for the future, is the development of diseases that will attack weeds and thus control them.

Another series of reports warranting considerable attention by the herbicide and pesticide industry was a panel discussion of the Miller Admendment as it affects herbicide research and use. Participating in this panel were Jack Dreessen, National Agricultural Chemicals Association; Charles Herrmann, U. S. Department of Health and Education and Welfare; J. T. Coyne, U. S. Department of Agriculture; and R. D. Sweet, Cornell University.

M. T. Goebel, E. I. duPont de Nemours & Co., reviewed industry views on modern weed control. A panel discussion on "Herbicide Regulatory Problems in the United States" included as participants C. J. Gilbert, U. S. Department of Agriculture; E. A. Epps, Jr., Louisiana Department of Agriculture; and L. Harris, Chipman Chemical Co., Boundbrook, N.J.

Weed Control in Corn

SEVERAL reports on the control of weeds in field corn and silage corn, were featured at the northeastern weed meeting. A preliminary study outlined by H. A. Collins and R. J. Aldrich, of New Jersey, showed that pre-emergence treatments with TCB sodium salt gave significant control of broadleaf and grass weeds with the exception of a ½ pound rate on grasses. R. S. Bell and E. J. Bannister, Rhode Island, discussing investigations of eight herbicides as pre-emergence sprays on silage corn, announced that DN Premerge and 2, 4-D give satisfactory weed control. "More complete control was attained however, where Karmex W, Karmex DW and the sodium salt of trichlorobenzoic acid were applied."

Further discussing new herbicides on corn, M. M. Schreiber, New York, reported effective weed control without crop injury with ACP L-841 at 4#, CDAA at 6#; and Niagara 5519 at 8#. J. Vengris, Massachusetts, reported that under conditions of several investigations he made, the most promising herbicides for eliminating annual weedy grasses in field corn are Dalapon, CDAA, and aminotriazole.

M. M. Schreiber, New York, reported also results of a series of investigations on the effects of 2,4-D and MCP on yield of oats and alfalfa. He reported that MCPB is not injurious to oats and there is no significant difference between 2,4D and MCP in oat response. MCPB, he said, appears to be non-injurious to alfalfa. It was pointed out in other discussions that the safest material to use on clover is MCP, with the phenoxybutyrics an intermediate between MCP and 2,4-D. 2,4-D it was said, is much more toxic to clover than MCP.

Weed control in grasslands is one phase of agricultural research which has increased in importance in recent years. Discussing renovation of such lands, J. Vengris, Mass., told the weed conference attendance that Dalapon at 10 to 15 pounds per acre and TCA at 30 lbs are promising materials for the elimination of bluegrass and bentgrass sods. He said, too, that fall applications of chlorates (Atlacide, Chlorax, powder) gave promising results in recent trials. S. W. Hart and J. A. DeFrance, Rhode Island, studies on control of crabgrass indicated that 96 to 100 percent control is obtained with Crab-E-Rad, Di-Met, Benzar, Methar and PMAS. Sodium arsenite, Scutl, American Cyanamid mixtures #1 and #3 were not so effective in one treatment at the rates used.

R. B. Engel and C. R. Skogley, New Jersey, advised that good control of crabgrass was obtained with the standard materials potassium cyanate and phenyl mercury acetate. . . and that among the experimental arsenicals tested, best results were ob-

tained with methyl arsonic acid, cacodylic acid and disodium methyl arsonate.

Herbicide studies on tomatoes, potatoes, leaf crops, onions, beets, sweet corn, and other fruits and vegetable crops were featured in some 30 reports presented at the meeting. R. J. Zedler, Carbide and Carbon Chemicals Co., suggested that the use of the experimental herbicide "Natrin 80 S" be encouraged next season on tomatoes. . .that the use be on a limited scale, however, until the grower becomes familiar with use under local conditions. L. L. Danielson, Norfolk, Va., advised that spinach shows a practical tolerance of a pre-emergence spray application of a combination of CIPC and Endothal, which kills both chickweed and henbit as well as grasses. M. F. Trevett, Maine, reported that mixtures of DN and CDEA or DN and CDED, when applied pre-emergence to weeds (on snapbeans) are complementary in their effect rather than additive.

At rates generally recommended for weed control in lima beans, NAP CP and ChloroDEC gave much better weed control in 1955 than DN-amine or DN-acid when a long period of hot, dry weather followed seeding and herbicide application, and when 2 inches of irrigation was applied. This summary was presented by E. M. Rahn, Delaware, in a comparison of several herbicides for lima beans. Similar studies on kidney beans reported by E. R. Marshall, G. Bayer and D. Robinson, Ithaca, N.Y., showed that the most promising materials are CDAA, CDEA and CDES.

Weed Control in Sweet Corn

W. H. Lachman, Massachusetts; M. F. Trevett, Maine; S. K. Ries and B. H. Grigsby, Michigan; R. D. Sweet, C. R. Benedict, and G. Crabtree, New York; were among the speakers discussing weed control in sweet corn. Based on their reports, the following chemicals gave effective or promising results: Karmex formulations, CDEC, TCB Heyden TCB, ACP-841, and Naugatuck 3Y9. In comparative tests, Lachman indicated that 2,4-D applications to the crop resulted in the poorest weed control.

Pre-emergence applications of .2 pound of CMU FW, .5 pound of TCB acids (Heyden), 4.5 pounds DN or 9.0 pounds of amino triazine per acre gave approximately the same order of broadleaf weed and annual grass control without marked injury to sweet corn, and without significant differences in yield of snapped ears per acre, according to the results outlined by M. F. Trevett. ★★

Nitrogen Production Capacity at 3.6 Million Tons in '56

U. S. capacity for production of anhydrous ammonia stood at an annual rate of 3,545,000 tons on January 1, 1955, equivalent to 2,920,000 tons of nitrogen, according to a survey conducted by the Chemical and Rubber Division, U. S. Department of Commerce, and published in the December 1955 issue of *Chemical and Rubber*. Capacity as of Jan. 1, 1955, represented an increase of 108% over that in existence on January 1, 1951, when the big nitrogen expansion program got under way. Since January, 1955, additional plants have also been completed, and gone into production, and it was estimated that capacity would reach 4,072,000 tons of ammonia, or 3,353,000 tons of N by January 1, 1956, and at least 4,757,000 tons of ammonia, or 3,917,000 tons of N early in 1957.

With the addition of an estimated 265,000 tons of N from by-product (coke oven) materials and organic wastes, it was estimated that total domestic nitrogen capacity in all forms would reach 3,618,000 tons by January 1, 1956, exceeding by 118,000 tons the nitrogen goal of 3,500,000 tons set for January 1, 1957 by the Office of Defense Mobilization in the original planning. The number of plants increased from 19 in January, 1951, to 35 in January, 1955, and is expected to reach 52 by early 1957.

Production of anhydrous ammonia has been increasing every year since 1948, and output has generally exceeded rated capacity. However it was expected that total output for 1955 would be below capacity, and it was predicted that unless demand for ammonia increases greatly in 1956, production will not exceed 80 to 90% of capacity for this year. In view of the margin of supply over demand it is also predicted that imports of solid nitrogenous materials will also continue to decline.

The survey indicates that use of ammonia increased 16% in 1954 over 1953. Even so, it did not quite keep pace with the increased supply. Reported distribution was only 94% of production in 1954, as compared with 98% in 1953, indicating that producers' inventories must have increased in 1954.

The proportion of the total output of anhydrous used for fertilizer in 1954 was substantially larger tonnage-wise than for 1953, (1,577,000 tons N as compared with 1,223,400 tons N) and was also greater percentage-wise (74 as compared with 67%). The breakdown for the two years shows the following totals for the three fertilizer categories in short tons of N:

	1953	1954
Total fertilizer use	1,223,400	1,577,000
production of solid materials	529,600	666,600
anhydrous ammonia and solutions used for mixed fertilizers	436,200	510,700
anhydrous ammonia and solutions used for direct soil application	257,600	399,700

With use of anhydrous ammonia by the fertilizer industry accounting for almost three out of every four tons produced in 1954, reported overall distribution of ammonia and derivatives for industrial purposes declined from 32% of the total in 1953 to 28% in 1954. Exports showed a gain in 1954, with exports of anhydrous and aqua only amounting to 33,1000 tons of N as against 20,600 tons in 1953.

NEW LIQUID MIXED FERTILIZER PLANT IN OPERATION

Figure 1. General view of Phillips liquid mixed fertilizer plant at Scottsbluff, Neb. The 30,000 gallon aqua ammonia and product storage tanks are shown in the background.

By
C. E. Franklin
Phillips Chemical Company,
Bartlesville, Okla.

EARLY last June Phillips Petroleum Company placed a 40 ton per day liquid mixed fertilizer plant on stream at its former Curry Chemical Division Scottsbluff, Nebraska, location. This plant served as a liquid mixed fertilizer development and demonstration plant for the fertilizer industry. In September this plant was sold along with the Scottsbluff operations of the Curry Chemical Division of Phillips to the J. R. Simplot Company.

From all indications liquid mixed fertilizers will experience the same phenomenal growth which anhydrous ammonia has experienced during the past seven years. With the aim to promote progress and to overcome many of the initial shortcomings in the manufacture of liquid mixed fertilizers, Phillips elected to erect a liquid mix plant to gain operating know-how and technical information on the formulation of liquid mixed products and to serve as a liquid fertilizer demonstration plant.

In selecting the type process by which liquid mixed fertilizers could be manufactured, the following objectives were desired: simplicity of operation, maximum efficiency, minimum of maintenance, and low investment. After a thorough investigation of the many processes by which liquid formulations can be manufactured, a batch type process was selected which uses aqua ammonia as the source of nitrogen and provides for controlled cooling of the liquid mixed fertilizer.

The neutralization of phosphoric acid with ammonia liberates a considerable amount of heat, sufficient to cause the neutral fertilizer solution to boil. Research data indicates ammonia losses are detectable from neutral ammonium phosphate solutions at temperatures of 160°F., and the loss increases with temperature until, at 210°F., the loss of ammonia becomes a significant operating cost factor. When neutralizing phosphoric acid with aqua ammonia, the heat of reaction is not of the magnitude of that with anhydrous ammonia since a portion of the heat is liberated in the conversion of anhydrous ammonia to aqua ammonia. In the Phillips plant a major objective was to produce liquid mixed fertilizer with no ammonia losses, thus requiring that temperatures in the neutralization step be held below 160°F. at all times. The necessary cooling is actually provided in two steps; first, the anhydrous ammonia is converted to aqua ammonia and the aqua is cooled; second, during the neutralization of phosphoric acid with the aqua the reacting mixture is continuously cooled. The decision to use aqua rather than anhydrous ammonia was influenced by the fact that aqua, as an intermediate product, would furnish an additional noncorrosive low vapor pressure liquid nitrogen fertilizer which could be handled and applied with the same equipment that is used for liquid mixed fertilizers.

Process Description

TWENTY-FIVE percent aqua ammonia is produced by reacting anhydrous ammonia with water in an aqua converter (Figure 2). The addition of anhydrous ammonia to water results in a reaction in which heat is evolved and the resultant temperature of the aqua product ranges between 130 and 160°F. Following the converter the aqua is cooled to a temperature below 90°F. by passing through coils located in an evaporative type cooling tower. The cooled aqua ammonia is then transferred to a 30,000 gallon aqua storage tank. One tank car of anhydrous ammonia containing approximately 25 tons can be converted to 27,400 gallons of 25 percent aqua in approximately six hours.

In order to recover any ammonia vapors discharged from the aqua storage tank, the tank is vented through a small ammonia scrubber which is located at the top of the storage tank. This scrubber is a vertical pipe to which the ammonia-containing vapors are introduced near the bottom. A series of water sprays

located systematically near the top of the scrubber admit water which absorbs the ammonia and drains as very dilute aqua ammonia from the bottom of the scrubber to the scrubber water tank. The water from this tank is continually recirculating over the scrubber. The ammonia in the scrubber water is ultimately recovered by using this water, approximately 2500 gallons, in the manufacture of aqua ammonia and refilling the scrubber water tank with fresh water.

The reactor circuit comprises a 1500 gallon carbon steel aqua ammonia measuring tank, a 1000 gallon stainless steel phosphoric acid measuring tank, a small stainless steel reactor, a 3000 gallon carbon steel reactor tank and a cooling unit. The first step in this batch operation is the acid neutralization which is carried out in the following manner. For a given formulation the pounds of nitrogen in the form of aqua ammonia and the pounds P_2O_5 in the form of phosphoric acid are calculated for a desired volume of product. The required volume of aqua ammonia is metered into the aqua measuring tank through the aqua loadout meter from the aqua storage tank. The required volume of phosphoric acid is transferred from a tank car into the calibrated acid measuring tank. The water required for the formulation is metered directly into the reaction tank. The two measuring tanks located above the reactor tank are connected to the reactor, and the reactants flow by gravity into the reactor. Hand operated valves are located in each line to control the rate of flow.

The stainless steel reactor is a small diameter vertical tube extending slightly above the top of the reactor tank and discharging near the bottom of the reactor tank. Three lines enter the top of the reactor: the aqua ammonia line, the phosphoric acid line and a product recirculate line from the cooling unit (Figure 3). The recirculating solution from the cooling unit serves two purposes: first, it absorbs a portion of the heat of neutralization caused by the reaction of aqua ammonia with phosphoric acid, thereby cooling the resulting stream below 150°F. and second, the recirculating stream dilutes the neutralized ammonium phosphate solution which is formed in the reactor. After thorough mixing in the reactor, the solution discharges into the carbon steel reactor tank and is essentially a neutral non-corrosive product having a pH of 6.8.

The cooling unit (Figure 2), an evaporative type cooling tower, is equipped with two sets of coils, one for cooling the aqua ammonia from the converter and the other for cooling the recirculating side stream from the reactor tank. Two sets of coils in the cooling unit make for flexibility, in that anhydrous ammonia may be converted to aqua while liquid mixed fertilizers are being formulated. Operating with two independent sets of coils eliminates the possibility through an operating error that a mixed solution might be introduced into pipes or coils containing aqua ammonia which would result in solid mono-ammonium phosphate being formed, plugging the coils, which could result in a costly shutdown.

Operating Procedures

THE rate at which the reactants, aqua ammonia and phosphoric acid, are added to the reactor is controlled with reference to the solution temperature in the reactor tank. As indicated by research data when operating with a solution temperature of 160°F. and above, there is a noticeable oder of ammonia above

(*Turn to Page* 116)

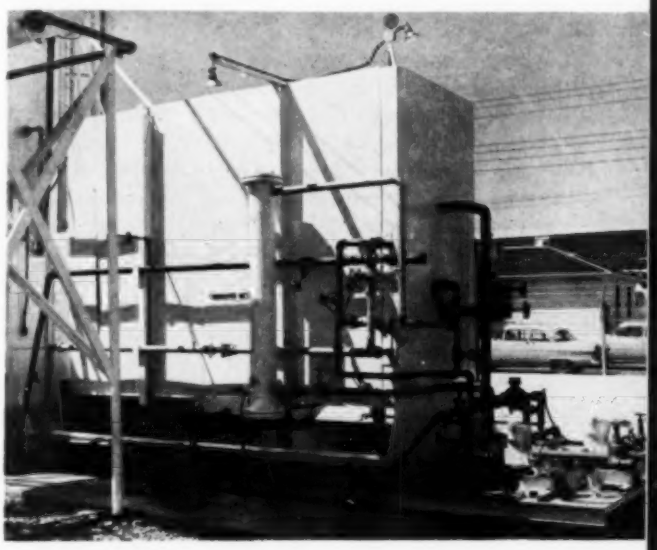


Figure 2. Cooling tower with aqua converter. The switchboard, all pumps, and load-out meters are located on this skid mounted unit.

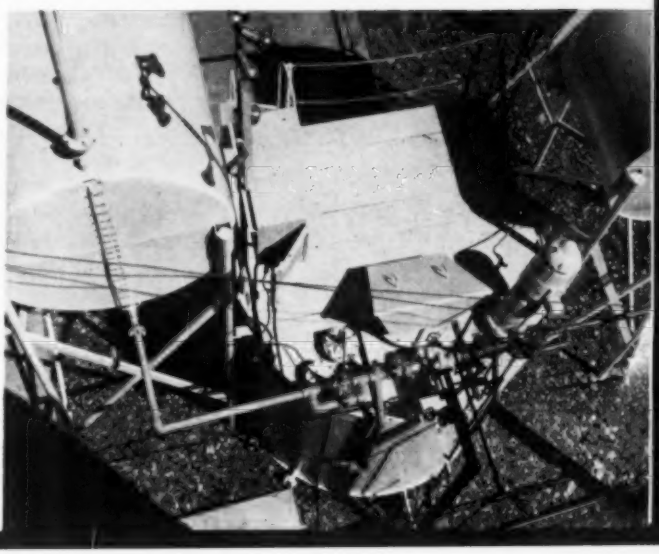


Figure 3. Top view of the reactor tank showing the measuring tanks located on each side of the reactor tank. The mixer motor is shown to the right of the reactor and pH electrode assembly is shown on the left side of the reactor.

FERTILIZER
Views and News

By Vincent Sauchelli

Nitrogen Consumption

WE learn that a survey of nitrogen utilization in Indiana, Ohio, Illinois, Missouri and Iowa shows that thousands of corn fields receiving an average of only 40 to 50 lbs. nitrogen per acre are almost completely depleted of their available nitrogen by August 15th. More than 50% of the cornfields in the Corn Belt area this past year (1955) showed signs of N starvation - lower leaves "fired" - by the middle of August. This is the time when the corn plant begins its "big pull" for nutrients to send to the developing ears of corn. Ears are filling and corn plants cannot grow big, plump, well-filled ears without adequate supplies of N, P, K. Instead of 40 to 50 lbs. of N per acre farmers would be well repaid to apply 100 to 125 lbs. of actual N. If a farmer can produce an extra bushel of corn with 2½ to 3 lbs. of N - assuming P & K and moisture are present also - at a cost of about 35¢ to 45¢ a bushel, he is robbing himself of needed profits if he is producing only 40 or 50 bushels of corn p. a. when he might be producing 90 to 100 bushels. The extra bushels at low cost could easily increase the return on his investment in fertilizer by 50%.

An average consumption of actual nitrogen per acre on corn belt farms varies from 4 to 7 lbs. This average reflects the fact that thousands of growers do not yet apply nitrogen except the wee bit in the starter fertilizer which usually represents 100 to 200 lbs. p a. of a 3-12-12 or a 4-16-16. If we divide the 4 to 7 lbs. of N among the 12,000 to 16,000 corn plants distributed over an acre, what possible aid or stimulation could those plants get out of that pinch of N they receive? Some people still believe in miracles. This is on a par with those optimistic farmers who insist on buying organic matter for their crop fields in the form of fertilizer which contains at the most only about 200 to 300 lbs. of a low quality material in a ton of a low grade fertilizer. Such a fertilizer is spread on the field at about 300 to 500 lbs. per acre, which means that 60 to 100 lbs. of the sludge or treated leather or similar low grade organic is distributed over 43,500 square feet: Really, it is amazing what faith some folks have in this "natural organic" fertilizer concept.

Bushels or Pounds?

MARKETING farm products has lately been coming in for much criticism from the Weights and Measures people in many States. Measuring wheat, corn, barley, rye and soybeans and other farm products by the ancient method of bushels, they say, is the hard, unscientific way and it gives no credit to quality. Generally the farmer's grain is measured by both scales and bushel as it proceeds from the farm barn to the miller, to the distributor and finally to the retail store. In all this measuring rigmarole there's a changing back and forth from dry bushel measure to hundredweight, hundredweight to bushel, and so on, a half dozen times or more.

Why not, say the critics, do the job the easy way from the very beginning of the operation, which is by weighing, and also give the progressive farmer credit for quality as well as volume? On the vast wheat and corn farms of the West it would be out of the question to measure the tremendous harvest by means of bushel measures. Imagine the task of measuring the yield of 10,000 acres of wheat by the bushel route. They use giant scales big enough to weigh a truck and all it contains and then calculate the contents in terms of commercial bushels in order to pay the farmer. The grain dealer who buys and pays for the grain on the basis of bushels sells it to the processor in so many hundredweights because freight is figured on that basis. The manufacturer recalculates the freight computations to a bushel basis; but then when he sells the flour or feed made from the grain, he sells in pound units.

Instead of all this back and forth bushels to pounds to bushels to pounds basis why not eliminate the bushel measure and start selling at the farm, the dealer, the processor, the retail store on a pound or hundredweight basis. Why not, indeed!

N, P_2O_5, K_2O or N, P, K

ALONG the same lines many brave souls in our industry are asking, why not eliminate the P_2O_5 and K_2O notations for phosphorus and potassium and use in their place the symbols P and K, respectively. This would avoid much confusion. One meets these two sets of symbols constantly in the farm and technical journals as well as the expression "phosphoric acid" for the P_2O_5 symbol, when actually the intent is to signify "phosphorus" which is correctly represented by "P". I recall an old slogan familiar to older folks which could apply aptly here: "If eventually, why not now".

This change-over is an accomplished fact in some European countries. The American Society of Agronomy and the Soil Science Society of America are on record as favoring

the change to N,P,K. State laws will have to be changed and historical data will have to be converted. This will all take time. Meanwhile, it might be possible to make a start by showing the fertilizer analysis guarantee on the bag or tag in both notations. Farmers would gradually become accustomed to the change-over and in due time accept it completely.

Soluble Phosphates

APROPOS of the item on soluble phosphates in this column in the November Issue the following comments by Dr. Wm. A. Albrecht, Head of the Dept. of Soils at the University of Missouri, seem to apply most fittingly:

> "In order for chemicals to serve as improvement in crop production via plant nutrition; those chemicals must fit into the soil-plant chemo-dynamics moving the nutrients from the soil to and into the plant root. It has long been the belief that chemicals must be introduced into the soil-root setting in water soluble forms for their ready movement into the plant, presumably with the stream of transpiration. . . .
>
> "Water-soluble chemicals introduced into the soil do not improve that soil for crop production because their solubility makes them move right into the crop growing there as if it were a case of hydroponics. Soluble chemicals function because they are more rapidly reactive with the colloid of the soil rather than with the root of the plant. They are absorbed by the soil first and exchanged from there to the plant root later on. If all the chemical substances in the soil serving for plant nourishment were soluble and remained so after application, they would be lost from the soil to the rainwater percolating through it. Also, if all the nutrient elements required during the season for the production of the crop were in solution at planting time, the sprouting seed would be killed by the resulting high concentration of the salts in the absence of absorption".

At the Root Tip

AGRONOMISTS used to be taught that plant nutrients had to be in solution for the purpose of feeding the plant. In a general way this is true. A sort of hydroponics concept. However, a few enterprising scientists in the Middle West began to wonder about this concept. Some elements of it were not quite clear. How can the soil hold the plant nutrients in a sufficiently large supply during the entire cycle of crop growth if they are all in solution form? they asked. They reasoned that if the same supply of nutrients were put into a solution which was, as in hydroponics, to serve as the medium of plant growth it would require, in terms of necessary dilution, a great deal more water than the soil could possibly retain within the root zone. And if the supply for the entire season's needs were dissolved in the water that actually was within the reach of the roots, the concentration of the salts furnishing the nutrients would be intense enough to cause serious root damage and possibly kill the plant.

These inquiries led to experimentation and finally to the concept that nutrients such as calcium, ammonium, potassium, phosphate and magnesium are held adsorbed on the surface of the soil clay and humus by electrical forces—like iron filings on a magnet—and these same nutrients are exchanged for the hydrogen released by the living roots. Clay, therefore, holds the key to the chemical dynamics which occur in a living soil. Nutrients held by the clay are not lost to the drainage waters percolating through the soil: they are held in quantity and exchanged to the advancing roots as they contact the colloidal clay and humus. Some nutrients are not adsorbed by the soil clay and humus complex. The mechanism of attraction being the electric charge, those chemicals which carry a negative charge of electricity similar to that of the clay complex itself are rejected. The nitrate ion ($-NO_3$) which is present in sodium and ammonium nitrates, is among such repelled nutrients. The other nutrients previously mentioned as being held carry a positive charge, except the phosphate, which carries a negative charge but which is attracted to calcium in the colloidal complex and held by it. The free nitrate ions may readily be carried away by water percolating through the soil and this explains why we say that dressings of phosphate and potash have considerable residual value, that is, a large portion of these nutrients, not consumed by the crop in the season they are applied, will serve the succeeding crop, whereas nitrogen is depleted. In other words, it is possible to build up a fairly high level of phosphatic and potassic fertility by frequent dressings, but applied nitrogen dressings seldom carry over into the following season.

According to modern theory, then, plant nutrients are for the most part not present in the soil solution itself, but are retained on the surface of the clay and humus complex and released to the advancing root for hydrogen which is given off by the root tip cells during their respiration. The clay fraction of a soil is acid and as such behaves like any other acid. It is conceivable that the acid clay could acidulate other chemical compounds present in the other fractions of the soil, as for example, the silt. And further it could acidulate limestone, liberating carbon dioxide, or phosphate rock, to release available phosphorus. Thus this all-important clay fraction acts as an adsorber of plant nutrients, as an exchanger of these same nutrients and as a processing medium. As an adsorber of chemical ions it may be considered as doing a fine job of conserving fertility; as an exchanger of these nutrients to advancing roots it serves indispensably in feeding growing plants; and as a processor or acidulating agent it acts on raw minerals to release desirable plant nutrient elements; then by the exchange procedure previously noted it passes these acquired elements on to the plant roots.

From these considerations, which are admittedly only a brief recital of the complex chemical dynamics of the soil-plant relationship, we can appreciate how very important is the role of clay directly and indirectly in the life processes of plants, animals and humans.

Lop-sided Fertilizer Programs

IN addressing the annual conference of the Dairy Science Association at Massey College, Palmerston North, North Island, New Zealand last August, Dr. J. Melville, Di-

(*Turn to Page* 114)

PHOTO COURTESY WESTERN GROWERS ASSN.

TRONA® POTASH *for Agriculture*

In 1917 state fairs were awarding prizes for outstanding farm products just as they are today. Then as now, growers depended on Trona® MURIATE OF POTASH for high quality crops. For it was in 1917 that Trona, first to produce domestic Potash when World War I pinched-off foreign sources, shipped the first train-load to the east coast. For the next twenty years Trona was the *only* domestic source of Potash and today, in spite of AMERICAN POTASH AND CHEMICAL CORPORATION'S broad diversification program, is still one of the primary basic suppliers of high grade Muriate and Sulphate of Potash for Agriculture.

PRODUCERS OF—

BORAX	BROMINE
POTASH	CHLORATES
SODA ASH	PERCHLORATES
SALT CAKE	MANGANESE DIOXIDE
LITHIUM	

—and a diversified line of specialized agricultural and refrigerant chemicals

MURIATE of POTASH, agricultural grades 95-98% KCL, (60% K_2O minimum), regular and granular.
SULPHATE of POTASH, agricultural grade, 95-98% K_2SO_4 (51% K_2O minimum).

TRONA

American Potash & Chemical Corporation

Offices • 3030 West Sixth Street, Los Angeles 54, California
99 Park Avenue, New York 16, New York
214 Walton Building, Atlanta 3, Georgia

Plants • Trona and Los Angeles, California; Henderson, Nevada
San Antonio, Texas (American Lithium Chemicals, Inc.)

Export Division • 99 Park Avenue, New York 16, New York

LISTENING *Post*

Fungicide Tests on Powdery Mildew and Cherry Leafspot

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Epidemics and Identification Section, Horticultural Crops Research Branch, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

R. M. Gilmer of the New York State Agricultural Experiment Station writes that the results of 5 years of fungicide tests for control of powdery mildew and leafspot of cherry nursery stocks demonstrated that both timing of the initial application and choice of fungicide were critical for disease control. Under normal western New York conditions, the initial application should be made 10 to 4 days after budbreak, i.e., usually about June 10 to 15.

A combination of actidione (2 ppm) and sulfur (2 to 5 lbs.-100) afforded outstanding control of both diseases when used in a 4-application schedule with applications at 14-day intervals. Actidione (2 ppm) in the same schedule gave excellent leafspot control, but control of powdery mildew, while comparable to that obtained with copper fungicides, was not highly satisfactory.

Copper fungicides at rates as low as 0.4 lbs. actual metallic copper per 100 gallons usually gave good control of leafspot but poor control of powdery mildew. None of the remaining fungicides tested gave acceptable control of both diseases in a 4-application schedule.

In the western New York nursery area, the principal diseases of cherry nursery stocks are leafspot (*Coccomyces hiemalis*) and powdery mildew (*Podosphaera oxyacanthae*). Leafspot is injurious to sweet and sour cherries and to mazzard and mahaleb understocks on which cherries are propagated. Serious injury from powdery mildew is usually confined to sour cherries, although the disease occurs to some extent on sweet cherries and mazzard understocks.

Major injury from leafspot is incurred during May, June, and early July in western New York, after which time further progress is usually checked by dry weather. Outbreaks are also common in late September, but defoliation at this time of year is probably beneficial, since it hastens the maturity of the trees. The early season infections are capable, however, of reducing the caliper (See Table 2) and resultant grade of affected trees, and understocks with heavy infections may become refractory to budding because of cessation of growth.

Powdery mildew of cherries is typically a disease of mid-summer (July and August) in western New York. The fungus flourishes during periods with low rainfall, particularly if the nights are cool with heavy dews. Severe infections reduce normal terminal elongation, but unlike apple mildew, systemic infections of the growing points are rare.

Copper fungicides have given commercially acceptable control of leafspot in cherry nursery stocks, but control of powdery mildew with these materials has never been highly satisfactory. Tests were begun in 1951 to determine whether other fungicides or combinations would give superior control of both diseases.

1951 EXPERIMENTS: Development and severity of both leafspot and powdery mildew were rated as about average for the Dansville nursery area.

Initial screening tests of a number of fungicides were begun early in the season to obtain preliminary data on injury and leafspot control. The most promising materials were then tested in a replicated block of Montmorency sour cherry. The test block consisted of 2-year trees that had not been sprayed the previous season. The initial fungicide application was made on June 26, when a fairly heavy leafspot infection was already evident. Two additional applications were made at 14-day intervals.

Of the materials included in this test, only the two concentrations of Bordeaux mixture afforded satisfactory leafspot control (Table 1). Ferbam, in the schedule employed, failed to provide acceptable leafspot control, and phenyl mercury caused intolerable injury which became more severe as the season progressed. Only the two Bordeaux concentrations gave any degree of mildew control, and even this control was only fair (Table 1). The effect of these fungicides on growth of the trees is evident in Table 2.

These data, in addition to indicating differences in performance of the various fungicides, emphasized the fact that the initial application was made too late for good leafspot control.

Table 1. Effect of various fungicides on defoliation and control of leafspot and powdery mildew of Montmorency sour cherry, Dansville, 1951.

Fungicide	Total foliation[a]		Percent defoliation		Per cent leaves with lesions		Percent leaves injured[b]		Mildew rating[c]
	7/17	8/28	7/17	8/28	7/17	8/28	7/17	8/28	9/5
Ferbam 3-100 (1st application) Ferbam 1½-100 (2nd, 3rd application)	2212	2281	13	13	35	49	49	72	34
Bordeaux 1½-6-100	2340	2345	11	12	26	25	37	24	24
Bordeaux 3-6-100		2296	9	10	26	28	34	38	22
Phenyl mercury 1 pt.-100	2310	2310	7	8	26	40	33	48	34
Control	2285	2308	18	64	43	34	61	98	38
LSD 19:1	NS	NS	7	8	7	15	9	18	7
LSD 99:1	NS	NS	9	11	10	20	13	21	10

[a]Actual number of leaves produced on 100 terminals.
[b]Summation of leaves off plus leaves with lesions.
[c]Average percent leaves per terminal mildewed.
[d]Dates on which counts were made.

Table 2. Effect of various fungicides on caliper, height, and percentage Grade 1 trees of Montmorency sour cherry, Dansville, 1951

Fungicide	Rate	Mean caliper[a]	Mean height[b]	Per cent Grade 1 trees[c]
Ferbam	3-100[d]	.....		
	1½-100	10.3	45	87
Bordeaux	1½-6-100	13.2	48	94
Bordeaux	3-6-100	12.9	47	92
Phenyl mercury	1 pt.-100	9.9	41	81
Control		10.0	43	83

[a]Caliper is expressed in sixteenths of an inch diameter measured at a point 3 inches above the union of scion and understock.
[b]Height is expressed in inches from point of union to tip of central leader.
[c]Grade 1 trees are those with a minimum caliper of 9/16 inches and a minimum height of 42 inches.
[d]Lbs. per 100 gallons.

Table 3. Effect of two fungicides on growth and defoliation of Montmorency sour cherry, Dansville, 1953.

Fungicide	Total foliation[a]	Per cent defoliation	Per cent leaves with lesions	Per cent leafspot injury[b]
	June 30[c]			
Fixed copper (1½-3-100)	1657	2	10	12
Captan (1½-100)	1636	2	9	10
Control	1642	2	7	9
LSD 19:1	NS	NS	NS	NS
LSD 99:1	NS	NS	NS	NS
	July 22[c]			
Fixed copper	1859	3	9	12
Captan	1886	5	24	29
Control	1698	23	49	72
LSD 19:1	80	4	12	14
LSD 99:1	133	6	21	23
	August 25[c]			
Fixed copper	1875	5	14	19
Captan	1895	11	51	63
Control	1741	75	22	96
LSD 19:1	70	10	24	15
LSD 99:1	116	17	40	25

[a]Actual number of leaves per 100 terminals.
[b]Summation of leaves off plus leaves with lesions.
[c]Dates on which counts were made.

Table 4. Effect of two fungicides on caliper, height, and number of Grade 1 trees of Montmorency sour cherry, Dansville, 1953.

Fungicide	Rate	Mean caliper[a]	Mean height[b]	Per cent Grade 1 trees[c]
Fixed copper	1½-3-100[d]	10.9	39	83
Captan	1½-100	9.9	35	76
Control		9.9	33	77
LSD 19:1		NS	2	NS
LSD 99:1		NS	4	NS

[a]Caliper is expressed in sixteenths of an inch diameter measured at a point 3 inches above the union of scion and understock.
[b]Height is expressed in inches from point of union to tip of central leader.
[c]Grade 1 trees are those with a minimum caliper of 9/16 inches and a minimum height of 42 inches.
[d]Lbs. per 100 gallons.

Table 5. Fungicides and application dates employed in commercial nurseries, Dansville, 1954.

Fungicides	Rate	Dates of application
A. Ferbam	2-100	June 17
Fixed copper	3-3-100	July 7, July 25
B. Actidione	2 ppm	June 15, July 1, July 17,
C. Actidione plus micronized sulfur	2 ppm 5-100	Aug. 2, Aug. 21. Dates as in B
D. Bordeaux	3-3-100	July 1, July 22, Aug. 5.
E. Captan	1½-100	June 20, July 7, July 21,
Karathane	2-100	Aug. 11, Sept. 4.
F. Bordeaux	8-8-100	July 2, July 17, Aug. 4
G. Ferbam	2-100	July 9.

1952 EXPERIMENTS: The 1952 experiments were designed primarily to determine the effects of the timing of the initial fungicide application on control of leafspot. The season was unfavorable for the development of either disease in the Dansville area. The data obtained are not of sufficient interest to justify their inclusion here, but copper fungicides were again superior to the organic materials tested.

1953 EXPERIMENTS: The season was particularly favorable for leafspot, but powdery mildew did not become evident until late in the season and caused little damage.

Although the 1951 and 1952 experiments had indicated that the initial fungicide application should be made in early June, the press of spring planting frequently delayed grower applications until late June. To explore the timing of initial application further, the experimental plots were sprayed at the time that the first grower applications were being made (June 29). Only two additional applica-

(*Turn to Page 97*)

Table 6. Effect of fungicides on control of leafspot of Montmorency and Morello sour cherry, Geneva, 1954.

Fungicide	Per cent leaves with lesions				Per cent defoliation				Total leafspot injury[a]			
	Montmorency		Morello		Montmorency		Morello		Montmorency		Morello	
	7/20	9/11	7/20	9/11	7/20	9/11	7/20	9/11	7/20	9/11	7/20	9/11
Actidione 2 ppm	2	3	1	2	tr[b]	tr	tr	tr	3	3	1	2
Captan 1½-100	7	9	7	10	3	5	3	6	9	14	10	16
Bordeaux 1½-3-100	5	7	6	10	2	5	2	6	8	12	8	15
Control	14	27	15	30	4	16	5	16	17	43	20	46
LSD 19:1	5	8	5	9	NS	NS	NS	NS	6	10	7	11
LSD 99:1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[a]Summation of leaves off plus leaves with lesions.
[b]Less than 0.5 percent.

Hibernating Corn Borers Down Slightly: Boll Weevils Up

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

By Kelvin Dorward

RESULTS of a fall survey conducted by agricultural agencies in 23 States to determine the number of hibernating European corn borers shows the over-all average in the fall of 1955 to be slightly below the number found in the fall of 1954—164 larvae per 100 stalks compared with 190 in 1954. Nine of the eleven Eastern States surveyed recorded an increase in the number of hibernating larvae over 1954. Some of the more important increases in the East were Delaware, from 60 borers per 100 stalks in 1954 to 241 in 1955; Maryland, from 41 to 140; New Jersey, from 28 to 177; and Rhode Island, from 39 to 131.

Five of the 12 North Central States surveyed recorded increases over the 1954 fall population. Illinois recorded an average increase from 225 borers per 100 stalks in 1954 to 339 in 1955. Indiana increased from 102 to 172; Minnesota from 72 to 96; North Dakota from 37 to 47 and Wisconsin from 28 to 82. Decreases were recorded in the three North Central States which had the highest average of hibernating larvae in 1954. Iowa decreased from 497 larvae per 100 stalks in 1954 to 351 in 1955; Nebraska from 353 to 186 and South Dakota from 424 to 131.

The number of known infested States, 37, remains the same as in 1954 but the total known infested counties increased to 1,644. The greatest increase in new county records for the European corn borer was in the Southern States. Arkansas listed 18 new counties, Alabama 10, Virginia 7, Georgia 5, Mississippi 2, and Tennessee 1. Oklahoma recorded an increase of 3 counties and Nebraska 1.

Although primarily a pest of corn, the European corn borer in 1955 caused considerable concern in northern Alabama where the insect damaged pimento peppers to the extent that shipment of the peppers was discontinued in some areas before the entire crop was harvested. Of rather unusual interest was the finding of the borer in cotton stalks in Tennessee and Missouri during 1955. Overwintering fifth instar larvae were found in 1-2 percent of the damaged cotton stalks examined during a limited survey in Missouri.

Boll Weevils up in Ga., N. C., Tenn.

In the January issue of this magazine, it was reported that the number of boll weevils entering hibernation in the fall of 1955 in both Louisiana and South Carolina was considerably higher than in the fall of 1954. Hibernation surveys conducted in Georgia and North Carolina also show increases in both these States. In Georgia 5 samples or 90 square feet of surface trash were taken from each of 42 farms. The average number of weevils per acre of surface trash was 799 in the fall of 1955 compared with 99 in the fall of 1954. The 1955 average for areas in Georgia is as follows: Northwest, 678 weevils per acre of surface trash; north central, 242; east central, 629; and south, 1,742. The maximum number of weevils per acre found on one farm in Georgia was 9,680 in Tift County.

In North Carolina, collections to determine the number of hibernating boll weevils were made at five farms in each of 12 counties. The average number of hibernating weevils for all samples collected in the States was 4,146 per acre of trash compared with 1,334 in the fall of 1954. Comparable county figures are as follows: Cleveland, 290 in 1954 compared with 5,033 in 1955; Franklin, 1,065 with 2,710; Hoke, 484 with 7,744; Harnett, 1,334 with 1,646; Scotland, 968 with 14,714 and Sampson, 2,904 with 1,646.

The 1955 fall boll weevil hibernation survey in McNairy County, Tennessee, shows an increase over 1954. Nine-hundred and two live weevils per acre of ground trash were found, compared with 311 in 1954. The highest average number in any one sample was at the rate of 3,112 per acre of trash. The 1955 counts are the highest since 1952 when 2,259 were found.

In Mississippi, surface woods trash was collected in 7 counties and examined for hibernating weevils. Five delta and 2 upland counties were included in the survey, which showed an average of 5,054 weevils per acre of surface trash. Range for the samples was at the rate of from 0 to 27,830 weevils per acre. The fall boll weevil hibernation survey program was begun in Mississippi in 1955; consequently, there are no previous comparable figures.

Texas Grain Insect Survey

During the month of December, 1955, approximately 115 wheat fields in twenty-three Texas Panhandle counties were surveyed for insects that affect small grain. Greenbugs were found in every county surveyed, but counts were extremely low. The highest populations were found in Deaf Smith and Hansford Counties, ranging from 0 to 5 greenbugs per row foot. Although found in all counties surveyed, populations of both the corn leaf aphid and the apple grain aphid were very low. Thrips and flea beetles were found in practically every field surveyed but in very low counts, none sufficient to cause detectable damage. The brown wheat mite had increased over previous surveys, the increase being especially apparent in the dry land fields of the north and northwest panhandle counties

(*Turn to Page* 94)

WASHINGTON *Report*

by
Donald G. Lerch
Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

COME the dawn, and some folks are going to find that instead of a selling tool, they have hold of a "lion's tail." Selling pesticides on the basis of residue tolerance advantage is at best a two-edged sword, say some industry men just back from field trips.

They argue that the amount of technical knowledge often diminishes the farther it is removed from the source. Residue tolerances are set on the basis of technical information, with the final responsibility resting with the Food and Drug Administration. Certainly company salesmen, county agents, and growers, are not expected to be technical experts in the matter of residue tolerances.

On the other hand, think of the vast number of "sales points" you can make out of residue tolerances which are set and their comparative advantage or disadvantage with competitive materials. But scratch your head, and think of how many similar selling points your competition could make depending on the way information is interpreted and depending on the crops and uses you set for it.

Certainly everyone who loves selling is on a continuous treasure hunt seeking new selling points. Perhaps it is wise selling policy to exploit any seeming advantage resulting from the legal establishment of residue tolerances. On the other hand, every far-sighted industry and government representative would certainly agree that added confusion and doubt in the minds of pesticide users is not particularly advantageous to any one.

Furthermore, all pesticide chemicals upon which tolerances have been established are safe when used as directed in accordance with label instructions. Consequently the whole question is extremely technical and could cause a lot of trouble in the opinion of those we've checked.

In fact we've heard some pretty strong language on the subject, the general thought being—lay off!

* * *

The pesticide industry's educational and promotional program takes to the air with a special series of radio recordings being distributed on a public relations basis to selected stations from coast to coast. Well over 500 stations have already asked for the first recording which features the safe use of pesticide chemicals.

Featured speakers, each with a 3 minute feature are as follows: "Farm Safety in the Chemical Era," Maynard H. Coe, Director of Farm Division, National Safety Council; "How Safe are Today's Pesticides?" Dr. David E. Price, Assistant Surgeon General, Public Health Service, U. S. Department of Health, Education, and Welfare; "The New Law and You," Dr. A. L. Miller, U. S. Representative from Nebraska; "It's on the Label," Lea S. Hitchner, Director, NACA.

Donald L. Miller, NAC Editor, supervised the production of this series. These radio recordings, each carrying the four feature talks, are being sent to stations only upon specific request to the Association office. Mr. Miller is enclosing with the record a verbatim set of scripts so that radio farm directors receiving the material can spot the contents of each recorded feature at a glance. It is anticipated that many farm directors will develop special programs, including local interviews and reports to enhance the effectiveness of the recorded statements.

Radio farm directors at most of the nation's leading stations speak to millions of farmers and gardeners every day. Their programs attract widespread audiences, justifying substantial investments by leading advertisers as well as cooperation on the part of the U. S. Department of Agriculture, other federal agencies, and many state and local agricultural and garden leaders. The large initial response to this first offer by the Association assures a successful series.

Another similar offering, now in the process of development, will feature fungicides. This is in line with policy decisions made by the Association's committees. Several other radio features are also planned.

Want to test your smeller? What the nose knows has been considered most important by legislators in Utah and Nevada who issued a regulation stating that any liquid pesticide that resembled a beverage, but which did not have a distinctive odor, must have an odor added to it so it will not smell like a beverage—or language somewhat to that effect.

In any event the whole question of odors in connection with pesticides is one for company technical departments, and in many cases the problem has been to eliminate odors from pesticide chemicals. Furthermore, your idea and the writer's of what a certain something smells like might lead to entirely different conclusions.

However, without engaging in a "smelling contest" it is sufficient to report that the National Agricultural Chemicals Association opposed the regulation and succeeded in getting it withdrawn.

* * *

Many an anxious breath was drawn when word swept across the country that the Food and Drug Administration had cracked down

(*Continued on Page 94*)

Meet The Demand For High Analysis

Use

DAVISON'S TRIPLE Superphosphate

State Agricultural Experiment Stations and other authoritative sources are recommending fertilizers with ever increasing plant food units per ton. High analysis fertilizers are in demand because they give more for each fertilizer dollar. Meet this demand by incorporating Davison's *New* Triple Superphosphate in your formulation.

Davison's Triple Superphosphate has 45/46% available P_2O_5 and is supplied in the easy-to-use granulated form or run-of-pile.

Order Davison's Triple Superphosphate. For complete information, call or write.

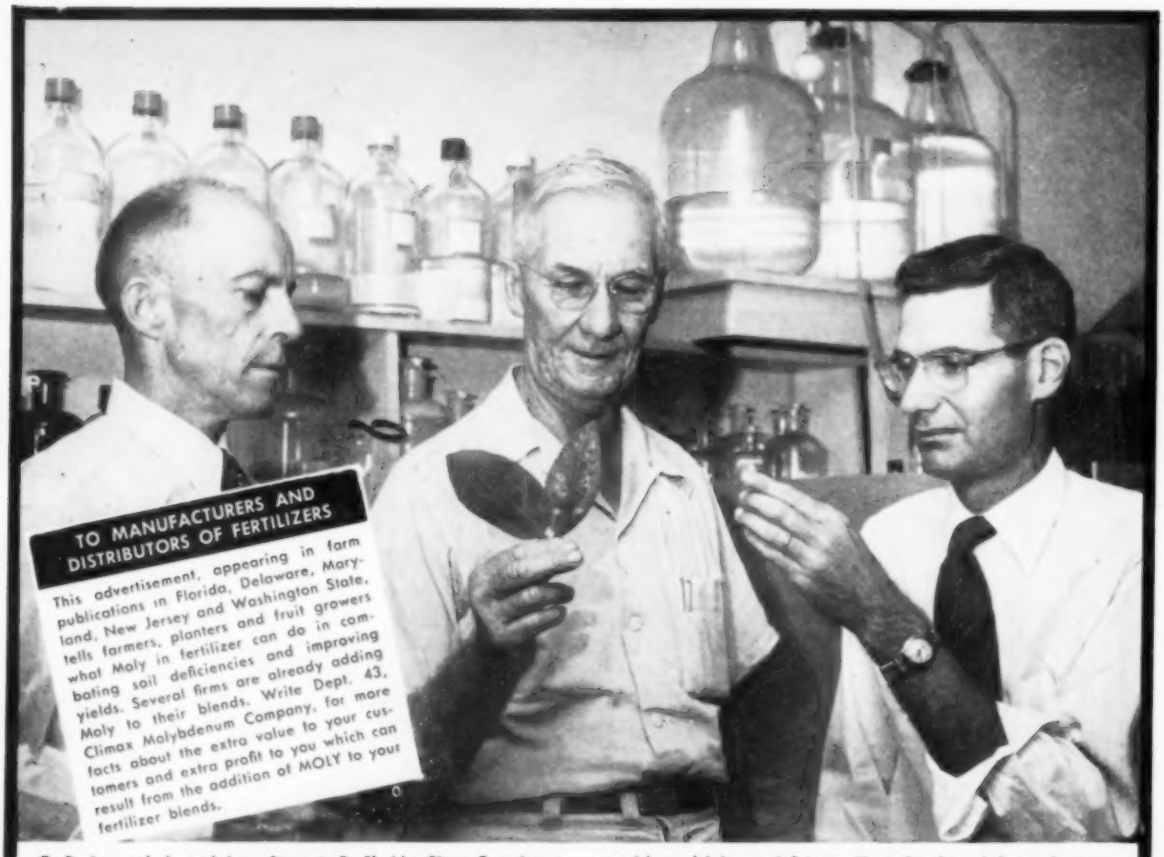
Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS AND SILICOFLUORIDES. SOLE PRODUCERS OF DAVCO® GRANULATED FERTILIZERS.



TO MANUFACTURERS AND DISTRIBUTORS OF FERTILIZERS

This advertisement, appearing in farm publications in Florida, Delaware, Maryland, New Jersey and Washington State, tells farmers, planters and fruit growers what Moly in fertilizer can do in combating soil deficiencies and improving yields. Several firms are already adding Moly to their blends. Write Dept. 43, Climax Molybdenum Company, for more facts about the extra value to your customers and extra profit to you which can result from the addition of MOLY to your fertilizer blends.

C. D. Leonard, L, and Ivan Stewart, R, Florida Citrus Experiment Station, talking with A. C. Mathias, citrus grower. Doctors Stewart and Leonard established the fact that *yellow spot* on citrus leaves is caused by molybdenum deficiency. They also showed that moly spray effects a rapid recovery of citrus trees affected by this deficiency disease. Many Florida citrus growers are now using molybdenum.

Florida experience shows how Moly controls crop disease

Water soluble Molybdenum can be spray-applied alone or mixed with other sprays.

Yellow spot on citrus leaves is caused by molybdenum deficiency, research discloses, and it can be controlled by spraying affected trees with sodium molybdate. Now Florida citrus growers are using molybdenum for the control of yellow spot.

All crops need moly—Other scientific tests conducted by experiment stations over the past 15 years have shown that moly is needed in *all* crops. If molybdenum is not present in the soil in a form *available* to plants, then it should be added. In legumes moly fixes nitrogen in root nodules. Moly acts in all crops to reduce nitrogen in the leaves. With such varied crops as tobacco, sugar beets, tomatoes, broccoli and rutabagas, added traces of moly make the difference between scanty growth and vigorous, healthy yields.

County agents can help — It may be that your own soil is deficient in available moly. Your county agent or soil conservationist will be glad to talk with you about the problem. Write for our bulletin, "Testing for Molybdenum Deficiency". Climax Molybdenum Company, Dept. 43, 500 Fifth Avenue, New York 36, N. Y.

MOLYBDENIZED FERTILIZERS
are made by
Davison Chemical Company
Division of W. R. Grace & Co., Baltimore, Md.
The Summers Fertilizer Co., Inc. McKeesport, Pa.

CLIMAX MOLYBDENUM

Pronounce it: Mo-LIB-de-num or call it Moly

Technical
SECTION

Chemical Control for Nematodes Seen Growing

METHODS of nematode control are usually considered in two broad categories: (1) exclusion, which is simply "quarantining" the area to keep out nematodes, and (2) learning to live with them. In this second category, crop rotation, cultural practices, use of resistant varieties, and chemical control are the main subdivisions; and it is the belief of J. N. Sasser, N.C. Agricultural Experiment Station, that the development of a practical field nematocide has given more impetus to further investigation in the field of nematology than any other single factor.

Ethylene di-bromide and D-D, which can be used on a field scale provide the grower and the research worker with a yardstick for comparing the yields and the quality of crops grown in soil relatively free of nematodes, with those grown in soil heavily infested with parasitic nematodes. Use of these soil fumigants has grown rapidly; for instance, the Commodity Stabilization Service, U.S.D.A., in its bulletin, "The Pesticide Situation for 1954-1955" estimates the present size of the soil fumigation market at between five and eight million dollars.

Soil Fumigation in N. C.

In North Carolina, 100 acres were treated in 1947; 800 acres were treated in 1949; in 1951 approximately 12,000 acres were treated; in 1953 approximately 100,000 acres were treated and latest figures for 1955 indicate that approximately 210,000 acres were treated. At the start of the program, broadcast or solid treatments were used primarily, and there was considerable custom work; but there has been a gradual shift to row treatment and this method was favored 2 to 1 for the 1955 season. The great bulk of treated soil in N. C. is for tobacco. The acreage treated represents only about one third of the N. C. crop.

List New Chemicals

In addition to these field fumigants, the use of methyl bromide for tobacco, celery and other seed beds has become very popular, Dr. Sasser said. An estimated 2 to 3 million pounds of methyl bromide was used last year, chiefly on tobacco, celery and other seed beds. Approximately 18 million sq. yds. of tobacco seed beds were treated in N. C. for the 1955 crop, and approximately 35,000,000 sq. yds. were treated with Cyanamid. Chloropicrin is still widely used but chiefly in greenhouse soils.

Nemagon (Shell Chemical Co.) which consists of a 1,2-dibromo-3-chloropropane, has shown promise as a nematocide. Nemagon has a rather high boiling point (196° C) and low volatility, and consequently high soil temperatures increase the efficiency of the material. It has been demonstrated to be an effective nematocide; however, the problem in using Nemagon is to determine whether the various crops are sensitive to the chemical at nematocidal dosages. Sensitivity of crops varies greatly. Tobacco, onions, and garlic appear to be most sensitive; potatoes, sugar beets and tomatoes are intermediate; cotton, peanuts and a number of vegetables appear to be quite tolerant. Nemagon seems to have a residual effect and also can be used on certain living plants.

Another new nematocide is Virginia-Carolina's V-C 13. This material is a complex phosphorus compound (0-2,4-dichlorophenyl-O, O-diethyl phosphorothioate) prepared as a 75% emulsifiable concentrate to mix with water. It is not a soil-fumigant in the usual sense of the term but has a low vapor pressure and a resultant long residual life. Experiments have shown that 10 to 14 days elapse after its application to infested soil before its activity as a nematocide becomes evident. Dosage rates now being recommended by the manufacturer range from 10 to 25 gallons of the 75% concentrate per acre, the actual rate fixed by the crop and growing conditions. V-C 13 also has a residual effect and has been successfully used to treat living annuals and perennials.

A third material which has shown considerable promise is Stauffer's Vapam (sodium N-methyldithiocarbamate). Vapam 4-s is a formulation of this compound containing 4 pounds per gallon in water. In soil, Vapam undergoes decomposition, producing isothiocyanate, a very effective penetrating gas. It can be applied by sprinkling or through irrigation systems and has proven efficient against certain weeds and germinating weed seed, nematodes, fungi and soil-borne insects. At present Vapam has federal registration as a preplanting soil treatment for ornamentals and vegetable transplant beds.

Use on Living Plants

Another material, 1-4 dichlorobutene, has been tested by various companies in the last several years and Carbide and Carbon Co. have formulations which show promise as a nematocide.

Fatty acids, such as heptanoic, capryllic, pelargonic, capric and undecanoic have been tested by Mallinckrodt Chem. Wks., through a cooperative arrangement with Drs. Tarjan and Cheo at Rhode Island. These acids have an extremely low vapor pressure and are not fumigants but show promise as disinfesting dips or sprays.

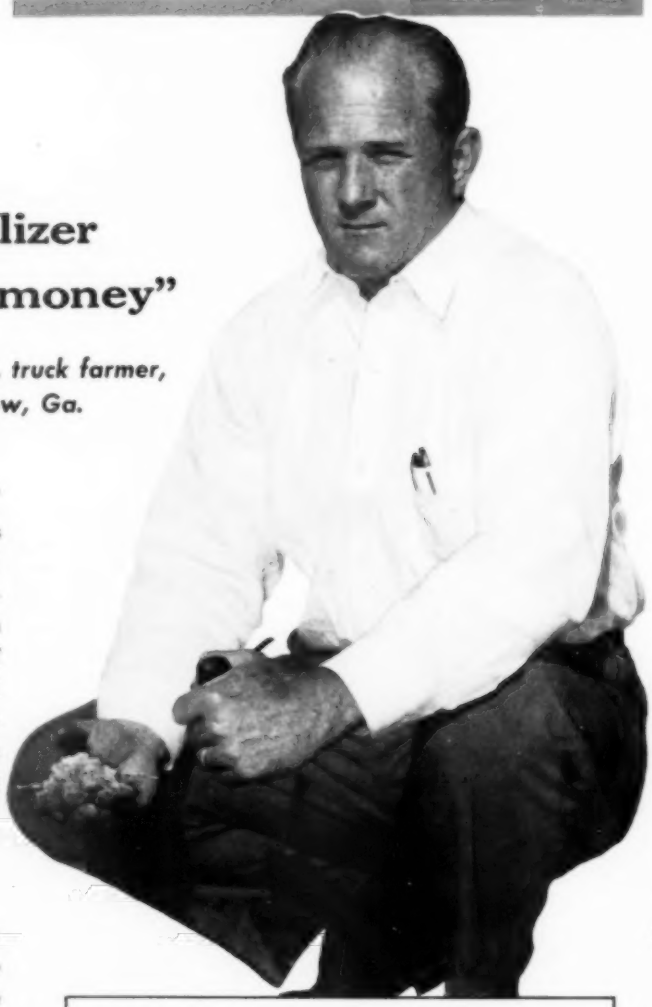
One encouraging thing about some of the newer nematocides is the

(*Continued on Page 64*)

HOW UNION BAG BUILDS MORE BUSINESS FOR THE FERTILIZER INDUSTRY

"Now I know... cutting down on fertilizer actually costs me money"

John Patrick, truck farmer, Marlow, Ga.



"I've known about fertilizer for a long time," says John Patrick, who with his brother Carl runs a 100-acre truck farm near Marlow, Ga., "but I didn't realize that every *dollar* invested in fertilizer can bring a farmer a *four dollar* return in crop value! That's how the U. S. Department of Agriculture figures it. Like a lot of farmers, I'd tried to *save* money by cutting down on fertilizer, but actually I was *losing* money, as I got lower yields on my crops. Now I know fertilizer is my best investment."

Union's information program increases fertilizer use

Mr. Patrick discovered his "profit formula" in one of the farm magazines he reads. The article was one of many prepared by Union as part of a countrywide newspaper-radio-television educational campaign to help farmers use more scientific methods.

One of the main purposes of this program is to show your customers how to make the best use of fertilizer. As one of the major manufacturers of Multiwall paper sacks for fertilizer, Union Bag is happy to make this contribution to the industry.

Mutual Fertilizer Company is one of the many leading manufacturers who package their products in Union Multiwall bags.

Mr. Charles Ellis Jr., President, Mutual Fertilizer Company, Savannah, Ga.

"I believe Union Bag's information program on the scientific use of fertilizer will help the farmers. Union does as well with its Multiwalls as it does with its fertilizer program. We use Union Multiwalls. They're among the best."

UNION Multiwall Bags

UNION BAG & PAPER CORPORATION · WOOLWORTH BUILDING, NEW YORK 7, N. Y.

FMC CHEMICALS

THE PLAIN TRUTH ABOUT PIPERONYL BUTOXIDE

It's one of the most amazing insecticidal synergists to come to light in the laboratory in recent years.

In combination with pyrethrum, *piperonyl butoxide* forms the *versatile* Pyrenone* concentrates — steps up the killing power of pyrethum at least 10 times. *Butoxide* itself has definite insecticidal properties. Yet it is virtually *non-toxic* to man or warm-blooded animals. It is equally as safe as pyrethrum, if not more so.

STABILIZES PYRETHRUM

Piperonyl butoxide also stabilizes pyrethrum in these two important ways:

1. **Reduces deterioration of pyrethrum by screening out ultra-violet light.**
2. **Acts as an acid acceptor and thus retards decomposition and polymerization of pyrethrum.**

Net result of this two-way stabilizing action is to increase the shelf-life of the end product — and to make it more effective in practical applications against insects for *longer* periods of time.

READILY SOLUBLE

Readily soluble in all common organic solvents, *piperonyl butoxide* is also a solvent in its own right. It minimizes, and often makes unnecessary, the use of other solvents and aromatics which may impart undesirable odors to end products. And because this superior synergist is an ether, *butoxide* is stable to the action of other chemical agents and exposure conditions—such as, heat, light and atmospheric changes.

For complete technical data . . . typical formulations for specific end uses . . . and sample label statements, write the nearest Fairfield Chemical Division office, Food Machinery and Chemical Corporation. Sales Headquarters: 1701 Patapsco Avenue, Baltimore 26, Md. Branches in Principal Cities.

*Reg. U. S. Pat. Off., F.M.C.

Pyrenone

FAIRFIELD CHEMICALS
TRADE MARK

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

Chemical Divisions

ORID-APEX *Plasticizers and Chemicals* **WESTVACO CHLOR-ALKALI** *Alkalis, Chlorinated Chemicals, Carbon Bisulfide* **FAIRFIELD CHEMICAL** *Insecticides and Organic Chemicals*
NIAGARA CHEMICAL *Insecticides, Fungicides and Industrial Sulphur* **BECCO CHEMICAL** *Peroxygen Chemicals* **WESTVACO MINERAL PRODUCTS** *Phosphates, Barium and Magnesium Chemicals*

(*Continued from Page 61*)

indication that they might be used on living plants. D-D and EDB, the only two field fumigants which are used on a wide scale today, are pre-planting fumigants and cannot be used on living plants. "Nematode Control," by J. N. Sasser presented at the National Meetings of the American Phytopathological Society, Atlanta, Ga., Dec. 28, 1955.

•

Anti-Growth Hormone Study

Weed and forest control workers have used for some time, analogues of plant growth hormones like 2, 4-D and 2, 4, 5-T with good success, but insect control still depends basically on chlorinated hydrocarbons like DDT, pyrethrins and similar substances, which poison the insect's nervous system. The control of insects by means of insect growth regulators which block growth or cause abnormal growth has never been attempted, but in principle could yield important results. The first insect growth hormone has already been isolated.

Extracting a growth regulator from insects was first accomplished by Adolph Butenandt and Peter Karlson of the Max Planck Institute in Tübingen, Germany. They succeeded in crystallizing 25 mgs. of active hormone from ½ ton of silkworm pupae. The substance, in a concentration of about 10 parts per million, promotes growth in all groups of insects that have been examined, and is apparently the principal growth hormone of insects. It is nitrogen free, has the elementary formula $C_{18}H_{30}O_4$ and appears to be an unsaturated ketone. The precise structure of the molecule is not yet known, but when this is discovered one can hope that analogues will be synthesized and efforts will be made to find derivatives that will block insect growth.

The mechanism of action of this hormone is the subject of intensive world-wide research. In the United States the laboratories of Howard A. Schneiderman of the Zoology Department at Cornell University, and Carroll M. Williams of Harvard are continuing research along this line. The possible use of this hormone, analogues of it, and other insect hormones in insect control is being explored in the Cornell laboratories.

•

Methyl Parathion for Weevil

A detailed description of methyl parathion, an organic phosphate insecticide recommended for the control of aphids and spider mites on cotton, is contained in a new technical bulletin published by Monsanto Chemical Co.'s organic chemicals division.

Methyl parathion, like parathion (Monsanto's Niran), is non-translocating when applied to foliage. It has proved more effective than parathion against cotton boll weevil and is included in the official recommendation for cotton insect control.

Experiments now in progress indicate good potentials for the compound against aphids on grapes, aphids and weevils on alfalfa, and several other pests including beetles, caterpillars and mosquito larvae.

Combinations of methyl parathion and parathion are registered for use in California on a variety of horticultural crops. The two compounds are very similar, although a higher volatility is indicated for methyl parathion, imparting better fumigant properties to a spray.

•

Test Aromatic Fluorines

The possibilities of aromatic fluorine compounds as fungicides have been investigated and more than 40 compounds have been reported in a recent study by Illinois State Geological Survey.

A concentration of 0.8 ppm of 1-fluouro - 3 - bromo-4,6-dinitrobenzene was found to cause complete growth stoppage of *Aspergillus niger* in the laboratory. Compounds showing most promise as cotton protectors were the fluorodinitrobenzenes, a fluoronitrophenol, difluorobiphenols, and a diflourobiphenol sulfide. The fluorobiphenols and a corresponding sulfide were prepared in an effort to avoid staining which is an objectionable feature of nitro compounds.

Complete resistance to the fungi (*A. niger, A. flavus, Trichoderman sp.* and *Penicillium lutem*) was maintained with 0.25 percent of the fungicide 1 - fluoro-3-bromo-4,6-dinitrobenzene.

Gladiolus corms soaked in water solutions of one part fungicide (3-fluoro-4,6-dinitrophenol; 1,3-difluoro-4,6-dinitrobenzene; 1 - fluoro-3-iodo-4,6-dinitrobenzene; and 1-fluoro-3-methyl-4,6-dinitrobenzene) to 1,000 or 2,000 parts water for 15 to 60 minutes were protected from fungus growth as effectively as the best commercial fungicides, it was reported. Aromatic Fluorine Compounds as Fungicides, G. C. Finger, Frank H. Reed, and Leo R. Tehon, State Geological Survey, Urbana, Ill., 1955.

•

Woolly Aphid in New York

Spraying of growth above ground, beginning with the apple seedling or rootstock and continuing until the trees are dug for sale, is considered the most effective control program for the woolly aphid in western New York. This means treatment over a three-year period in most cases, and because initial infestations on apple seedlings or stocks originate from aphids migrating from elm trees in June, the spray schedule should begin early in June and continue during the summer.

Experiments have shown that if trees are sprayed at two-week intervals beginning in late May or early June and continued until August 1, infestation can be held to a minimum. In the nursery, benzene hexachloride, at two pounds of 12 percent gamma isomer per 100 gallons, or lindane (25 percent gamma isomer) at one pound per 100 gallons is quite effective against the aphids. Parathion (25 percent w.p.) at one pound per 100 gallons, or nicotine sulfate (40%) at one quart per 100 gals. was only moderately effective.

On East Malling rootstock propagating beds, one heavy thorough spraying of the tops and the soil around the base of the plants during June should provide good protection (over 90 percent) from root injury. Either lindane or dieldrin may be used in spraying, using four pounds of the 25 per cent wettable powder in 100 gallons of water. The Woolly Apple Aphid - A Problem of the Nursery and the Orchard. Foster L. Gambrell and Carl O. Hansen, *Farm Research*, Vol. 21, No. 4.

Nitroparaffins As Insecticides

The world's first large-scale plant for the production of nitroparaffins, now in the last stages of completion at Sterlington, La., may yield products for potential use as insecticides.

Four nitro-paraffins from Commercial Solvent's process are: nitromethane, nitroethane, 1-nitropropane, and 2-nitropropane. More than 2,000 derivatives have been prepared by CSC's laboratories from these four compounds. Nitroethane and nitromethane have been suggested for synthesis of insecticides.

Most important of the NP derivatives from a commercial viewpoint today are: 2-amino-2-methyl-1-propanol; tris (hydroxymethyl) aminomethane; hydroxylammonium sulfate; hydroxylammonium acid sulfate; and the Alkaterges. A considerable proportion of the NP's produced here will be converted to these derivatives either on location or in expanded facilities at CSC plants in Terre Haute, Ind., and Peoria, Ill. *Chemical and Engineering News*, Vol. 33, No. 33, August 15, 1955.

•

Ag. Chem.-Disease Report

A total of 391 cases of occupational diseases caused by the use of agricultural chemicals were reported in California in 1954, according to the State's Department of Public Health. About 40 percent of the patients lost no time from work and of the 182 cases reporting lost time, 86 percent lost two weeks or less.

The Bureau of Adult Health defines agricultural chemicals as:

"those organic and inorganic compounds prepared for their influence on the growth or destruction of plant and animal life when used or prepared for use in agriculture. 'Agricultural includes horticulture and warehouses dealing with products used primarily for agricultural purposes."

The study was based on the "Doctor's First Report of Work Injury" form, which is required by law to be filed by every physician who attends an injured employee covered by California's Workmen's Compensation Act. Since only such cases are reported, and since farmers can choose *not* to be covered, the complete extent of occupational diseases arising from the use of agricultural chemicals is not known.

Majority of cases (53 percent) were skin diseases. *California's Health*, Vol. 13, No. 6, Sept. 15, 1955.

•

Phosphates for Fruit Fly

Field experiments have been conducted in cherry orchards infested with cherry fruit fly, in Erie County, Pa., and results indicate that parathion, EPN, Diazinon and malathion give good control. Three applications of parathion or EPN were most effective of the treatments tried. A split schedule of lead arsenate and malathion, and lead arsenate and parathion greatly reduced the fruit fly infestation in a sweet cherry orchard, as did a split schedule of lead arsenate and Diazinon.

Sprays of parathion, EPN and Diazinon were also used with success against immature forms in the fruit. Although sprays of malathion greatly reduced the number of maggots that emerged from the fruit, the results indicate that this material is less effective than parathion, EPN and Diazinon.

Preliminary tests also showed that soil application with chlordane and dieldrin is not highly effective against the cherry fruit fly. Insecticides for Cherry Fruit Fly Control, James A. Co. *Journal of Economic Entomology*, Vol. 48, No. 5, p. 575.

•

Me Bromide for Tobacco in N.C.

North Carolina farmers have readily accepted methyl bromide gas for fumigating tobacco plant beds. Since its introduction in 1950-51, growers have found that this fumigant kills weeds, grasses and nematodes, and it is easy to apply, according to a note in the North Carolina Agricultural Experiment station report. During the 1953 plant bed season, about 1 1/2 million square yards were treated, while for the 1954 season the area covered jumped to around 9 million square yards. The station estimated that 50 to 60 percent of all growers used methyl bromide during the winter of 1954-55.

LITERATURE AVAILABLE

The following list reviews a series of bulletins on fertilizer, insecticide and fungicide recommendations, controls, etc. For the most part these bulletins and reports are prepared by the various state agricultural experiment stations, and copies may be obtained by writing directly to the respective stations.

TESTS FOR TYPE OF ACTION OF HYDROCARBON INSECTICIDES APPLIED JOINTLY, by Neely Turner. Objective of tests was to determine which type of action resulted from combinations of the following insecticides: DDT, TDE, DFDT, methoxychlor, Perthane, Dilan butane and propane, chlordane, heptachlor, aldrin, dieldrin, endrin, isodrin, lindane and Strobane. Results are classified in four groups: (1) materials producing parallel dosage-response curves, with toxicity consistent with similar action; (2) materials with non-parallel dosage-response curves with toxicity consistent with similar action; (3) materials with non-parallel dosage-response curves, with toxicity 23 percent lower than consistent with similar action; (4) materials with parallel dosage-response curves, with curves for mixtures much less steep than for the materials themselves. Bulletin 594, June, 1955, The Connecticut Agricultural Experiment Station, New Haven, Conn.

PAPAYA INSECT CONTROL. Contains information on the fruitfly, webworm, whitefly, hornworms, leafhoppers, insects as vectors of virus diseases and precautions on insecticide application. C. 136.

INSECTS AND MITES OF FLORIDA CITRUS. Describes and pictures principal insects and mites on citrus. C. 137.

GOODBYE MR. ROACH. Discusses important control measures, including preventing infestations, where to look for roaches, insecticide application and precautions in control measures. C. 138.

CONTROL OF INSECTS AND DISEASES OF DOORYARD CITRUS TREES. Features a pest control chart. For home-owners with citrus on the home ground. C. 139.

RELATION BETWEEN SOLUBLE PHOSPHOROUS IN FERTILIZED SOILS AND GROWTH RESPONSE OF PASTURE FORAGE. Gives experimental results of five to six years' work with pasture forage in Central, North Central and West Florida. #558.

COTTON INSECT CONTROL. Gives control measures for various insects, the insecticide to use, how to apply, and interval of applications. C. 130.

LYCHEE INSECT CONTROL. Carries a chart listing insects, materials for control, amount to use, and when to apply. C. 131.

Bulletins above may be obtained from: FLORIDA AGRICULTURAL EXPERIMENT STATION, Gainesville, Fla.

DESIGNING ENGINEERS AND CONSTRUCTORS

LUMMUS

FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

385 MADISON AVENUE, NEW YORK 17, NEW YORK

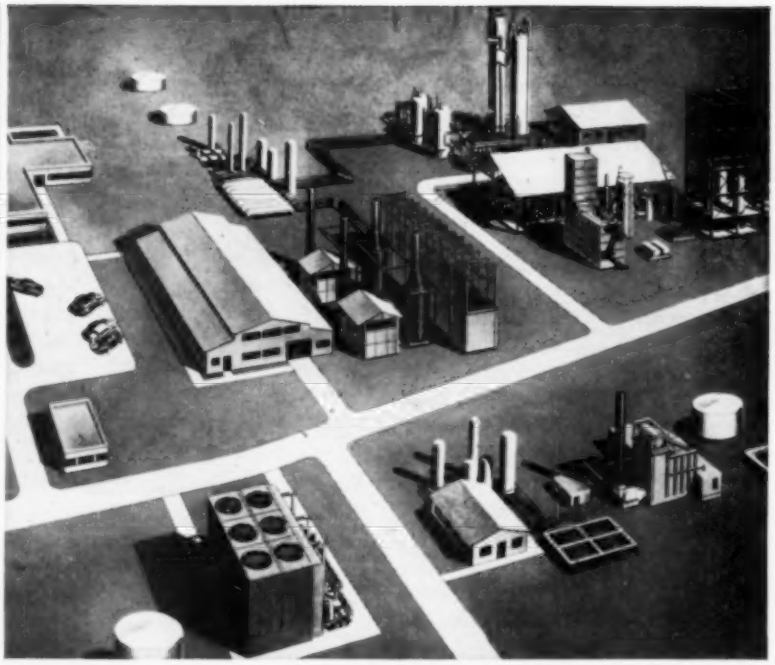
First Complete Ammonia Products Plant Planned For Puerto Rico

Lummus designed unit and will do construction

Construction will begin shortly on a new anhydrous ammonia, sulfuric acid and ammonium sulfate plant at Guanica, Puerto Rico for Gonzalez Chemical Industries, Inc., San Juan. With the creation of this industry, the second largest new endeavor on the island, another milestone is passed in the Puerto Rican Government's industrialization program.

The plant will provide a dependable source of ammonia-nitrogen and related products for fertilizer and industry of the island. This is of particular importance in times of international emergency when shortages may seriously handicap growers of sugar cane, tobacco, coffee and other industrial chemical developments.

Forty-two thousand tons of anhydrous ammonia will be produced per year. Part will be sold as such, and the balance will be converted to aqueous ammonia, sulfuric acid, ammonium sulfate and possibly other materials for use by agriculture and industry.



Artist's conception of complete ammonia products plant for Gonzalez Chemical Industries, Inc., Guanica, Puerto Rico.

This will make the fourth ammonia unit in two years for Lummus. It adds another to the 700-odd plants and installations completed by Lummus throughout the world. May our engineers serve you—at home or overseas?

The Lummus Company, 385 Madison Avenue, New York 17, N. Y. **Engineering & Sales Offices:** New York, Houston, Montreal, London, Paris, The Hague, Bombay. **Sales Offices:** Chicago, Caracas. **Heat Exchanger Plant:** Honesdale, Pa. **Fabricated Piping Plant:** East Chicago, Indiana.

AROMATIC FLUORINE COMPOUNDS AS FUNGICIDES, by G. C. Finger, Frank H. Reed, and Leo R. Tehon. More than 40 aromatic fluorine compounds were investigated. A concentration of 0.8 ppm of 1-fluoro-3-bromo-4,6-dinitrobenzene was found to cause complete growth stoppage of *Aspergillus niger* in the laboratory. Data are included on vinyl plastic and cotton fiber protection. Subsequent to the preceding investigations, additional work was done by the Natural History Survey on gladiolus-disease control. State Geological Survey, Urbana, Ill.

GROWING SWEET CORN IN ARIZONA, by W. D. Pew and L. Hopkins. The study reports that corn earworm should be controlled by using 5 percent DDT dust applied to the silk with a stencil brush or puff duster. Bulletin 264, Agricultural Experiment Station, University of Arizona, Tucson.

EFFECTIVENESS OF GRASSHOPPER CONTROL IN THE UNITED STATES by Claude Wakeland. The period 1937-1947 is covered in a review of control methods since Congress appropriated funds for an organized control program in cooperation with the states. Detailed test results are tabulated, state-by-state and year-by-year. Bulletin ARS-81-1 U.S.D.A. Agricultural Research Service, May 1955.

INDUSTRY PATENTS

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received outside of the United States the cost will be $1.00 per copy.

2,719,783. LOW VOLATILE COMPOSITION FOR CONTROLLING VEGETATION GROWTH. Patent issued October 4, 1955 to Gustave K. Kohn, Berkeley, Calif., assignor to California Spray-Chemical Corp., Richmond, Calif., a corporation of Delaware. A herbicidal composition comprising an inert carrier and the tetrahydrofurfuryl ester of 2,4-dichlorophenoxyacetic acid, said ester being present in the composition in phytocidal concentration.

2,719,784 LOW VOLATILE COMPOSITION FOR CONTROLLING VEGETATION GROWTH. Patent issued October 4, 1955 to Gustave K. Kohn, Berkeley, Calif., assignor to California Spray-Chemical Corp., Richmond, Calif., a corporation of Delaware. A herbicidal composition comprising an inert carrier and the tetrahydrofurfuryl ester of 2,4,5-trichlorophenoxyacetic acid, said ester being present in the composition in phytocidal concentration.

2,720,727 CONTROL OF PLANT DISEASES. Patent issued October 18, 1955 to Charles Pidacks, Montvale, N. J., assignor to American Cyanamid, New York, a corporation of Maine. The method of treating rhizomes comprising immersing the rhizomes in an aqueous solution of chlortetracycline.

2,721,124 HERBICIDAL COMPOSITION. Patent issued October 18, 1955 to John C. R. Warren, Elmira, Ontario, Canada, assignor to United States Rubber Co., New York, a corporation of New Jersey. A low-freezing concentrated herbicidal composition of matter in which the active herbicidal ingredient comprises a mixture of the isopropyl and sec-butyl esters of 2,4-dichlorophenoxyacetic acid in proportions of from 30 to 60 per cent of said isopropyl ester and correspondingly from 70 to 40 per cent of said sec-butyl ester, said percentages being by weight based on the sum of said esters.

2,721,130. HERBICIDAL COMPOSITION. Patent issued October 18, 1955 to John C. R. Warren, Elmira, Ontario, Canada, assignor to United State Rubber Co., New York. A low-freezing concentrated herbicidal composition of matter in which the active herbicidal ingredient comprises a mixture of the isobutyl and sec-butyl esters of 2,4,5-trichlorophenoxyacetic acid in proportions of from 40 to 75% of said isobutyl ester and correspondingly from 60 to 25% of said sec-butyl ester, said percentages being by weight based on the sum of said esters.

2,721,131. HERBICIDAL COMPOSITION. Patent issued October 18, 1955 to John C. R. Warren, Elmira, Ontario, Canada, assignor to United States Rubber Co., New York. A low-freezing concentrated herbicidal composition of matter in which the active herbicidal ingredient comprises a mixture of the isopropyl and isopropyl and isobutyl esters of 2,4,5-trichlorophenoxyacetic acid in proportions of from 20 to 50% of said isopropyl ester and correspondingly from 80 to 50% of said isobutyl ester, said percentages being by weight based on the sum of said esters.

2,726,980 INSECT REPELLANT AMINES PRODUCED BY REACTING 1,3-BUTADIENE AND AMMONIA AND METHOD OF USING SAME. Patent issued Dec. 6, 1955 to Lyle D. Goodhue, Bartlesville, Okla., and Carolyn E. Tissol, St. Paul, Minn., assignors to Phillips Petroleum Co. A composition suitable for the prevention of infestation of a roach habitat by roaches, containing as an essential active ingredient thereof a higher boiling amine product boiling in the range 307.4 to 316.4° F. at 3.7 millimeters of mercury, and a roach repellent adjuvant as a carrier therefor, which product has been prpared by reacting ammonia and 1,3-butadiene employing a catalyst, said catalyst being present in an amount within the range of 0.05 to 15 weight per cent of said reactants.

Trade Mark Applications

PANONEX, in capitals with "e" in lower case attached to "x," for plant growth aid. Filed Dec. 23, 1954 by Hydroponic Chemical Co., Inc., Copley, Ohio. Claims use since Dec. 9, 1954.

LEBANON SPRAY-GRO, in capitals with a large "sp" and diamond crest attached, for plant food. Filed Jan. 24, 1955 by Lebanon Chemical Corp., Lebanon, Pa. Claims use since Apr. 28, 1953.

STADLER'S TRIPLE X, in circle with three x's attached to arrow cutting the center, for lawn and tree feed. Filed Mar. 9, 1953 by the Stadler Fertilizer Co., Cleveland. Claims use since Nov. 1, 1932.

GRO-GREEN, in reverse type enlarging from left to right, for fertilizers. Filed Oct. 18, 1954 by Smith-Douglass Co., Inc., Norfolk, Va. Claims use since in the spring of 1947.

DELSAN, in capitals, for seed fungicide and insecticide. Filed Feb. 15, 1955 by E. I. duPont deNemours and Co., Wilmington, Del. Claims use since Jan 18, 1955.

TUCO, in heavy capital and lower case, for fungicides and insecticides. Filed Jan. 21, 1955 by The Upjohn Co., Kalamazoo, Mich. Claims use since Oct. 8, 1954.

UPCO, in heavy capital and lower case, for fungicides and insecticides. Filed Jan. 21, 1955 by The Upjohn Co., Kalamazoo, Mich. Claims use since Oct. 8, 1954.

PHIX, in large scrip capital and lower case raised toward right, for agricultural and horticultural fungicide. Filed Sept. 7, 1954 by Chemley Products Co., Chicago. Claims use since Feb. 20, 1954.

CHINCH-CHEK, with ch's in capitals, for lawn spray for the control of chinch bugs, army worms, mole crickets, grubs, and ants. Filed June 8, 1954 by Re-Mark Chemical Co., Inc., Miami. Claims use since Feb. 1953.

CELA, in large capitals, for insecticides for animals and insects, chemical composition for the destruction of weeds and plants, disinfectants. Filed June 11, 1954 by Cela Landwirtschaftliche Chemikalien G.m.b.H., Ingelheim am Rhein, Germany. Claims use since Dec. 10, 1951.

S.I.A.P.E., in capitals in bottom portion of incomplete circle with thin line drawn through the middle of circle, for fertilizers. Filed Mar. 24, 1954 by Societe Industrielle d'Acide Phosphorique et d'Engrais, Paris, France. Claims use since Feb. 15, 1954.

FIESTAR, in heavy script capital and lower case placed on a star, for multipurpose fertilizer which serves also as an insecticide, soil inoculant and crab grass germination inhibitor. Filed Jan. 10, 1955 by Fiestar, Inc., Roslyn Heights, N. Y. Claims use since Apr. 13, 1954.

KEY TO CHELATION, in Circle with eagle's claw in capitals for agricultural fertilizer. Filed July 14, 1954 by Versenes Inc., Framingham, Mass. Claims use since July 1952.

A Package Deal . . .

Custom Formulated MINERAL MIXTURE

Tennessee Corporation custom formulated mineral mixtures are tailored to fit your particular needs. We custom mix any combination of minerals to your own specifications. There is only one ingredient to add to your regular fertilizer formula to produce a completely balanced plant food. It requires no additional labor or mixing facilities, since **TC** mineral mixtures come to your plant in bulk or bag already mixed in controlled amounts of soluble and readily available forms of Copper, Manganese, Zinc, Iron, Magnesium and Boron. Cut down on multiple purchasing, raw material cost and handling by mineralizing with a **TC** custom formulated mineral mixture.

Samples, Specifications and Detailed Information Upon Request.

TENNESSEE CORPORATION

617-629 Grant Building, Atlanta, Ga.

INDUSTRY *News*

New NH_3 Distributor Builds

The Wayne Chemical Corp., New Bern, N. C., and Weil's Fertilizer Works, Inc., Goldsboro, N. C., have selected Goldsboro as the site for a new anhydrous ammonia distribution plant that is expected to be in full operation by March 1, 1956. A 30,000-gallon capacity tank will be erected shortly.

•

C. D. Vreeland, Sr., Dies

Cornelius D. Vreeland, Sr., 87, former president of the Illinois Chemical Co., died in January in Wayne, N. J. Mr. Vreeland is credited with an early patent for a process for producing lead arsenate. He was at one time assistant chemist with Stirling Iron Co., Stirling, N. Y.; vice-president and director of manufacturing of Kil-Tone Co., Vineland, N. J.; and president of Vreeland Chemical Co., Totowa, N. J.

•

New Pesticide Consultants

Dr. Joseph R. Haun, formerly plant physiologist for weed control research with the Grasselli Chemicals Department of E. I. du Pont de Nemours & Co., Wilmington, will become director of the newly established weed control division of Insect Control and Research, Inc., Baltimore, Maryland, a firm of consulting entomologists.

The new division of I.C.R. will conduct custom research projects on the adaptation of chemicals or by-products for herbicidal uses and will offer service and consultation on weed control problems for industry and government. Particular attention will be paid to weed control problems in Latin America where I.C.R. will expand its consulting service to oil and mining companies as well as road building and maintenance agencies.

•

Sinclair Names Sales Execs.

Sinclair Chemicals, Inc., subsidiary of Sinclair Oil Corp., announced the appointment of Anton M. Horehled as manager of nitrogen solutions for the Calumet Nitrogen Products Plant located at Hammond, Indiana.

John A. Corrigan was named district sales manager. He had previously been Sinclair Chemicals sales representative in Chicago, and will now manage the company's chemical marketing activities in the Midwest with headquarters in Chicago.

Collins Heads Chem. Salesmen

E. L. Collins, iodine sales manager for the Chilean Nitrate Sales Corp., New York, was installed as president of the Salesmen's Association of the American Chemical Industry at a luncheon held January 18th in the Biltmore Hotel, New York. Other new officers are: vice-president, V. L. Rebak, Grace Chemical Co.; treasurer, Robert J. Roberts, Emery Industries, Inc., and secretary, James E. Spencer.

E. L. Collins, new president of Chemical Salesmen's Association

National Agricultural Chemicals Association to Fla. March 14

The National Agricultural Chemicals Association will hold its 1956 spring meeting March 14-16 at the Hollywood Beach Hotel, Hollywood, Fla.

Top industry and government speakers on the program will discuss atomic energy in agriculture, the development and marketing of new pesticides, new uses for fungicides, USDA pesticide research activities, and the economics of the cotton industry. The theme, "Read the Label for Safety" will be highlighted in a report on the Association's greatly expanded safety and safe use program.

Following an opening address of welcome by president W. W. Allen, Dow Chemical Co., John A. Field, Carbide and Carbon Chemical Co., will discuss the development and marketing of pesticides. In a review of "50 Years of Food & Drug Laws," G. P. Larrick, Food & Drug Administration, will discuss the status of the Miller Law. G. L. McNew, Boyce Thompson Institute, is scheduled to report on the status and future of fungicides; and H. L. Haller, USDA, will discuss pesticide research and related matters.

The program is completed with discussions on pest control and atomic energy by S. B. Hendricks, Agricultural Research Service; and a discussion of cotton production economics by H. J. Johnston, National Cotton Council.

Cotton States ESA Meeting Scheduled for Feb. 6-8 in Atlanta

THE thirtieth annual meeting of the Cotton States Branch, Entomological Society of America, will be held at the Biltmore Hotel in Atlanta, Georgia, February 6, 7, 8, according to H. C. Young, branch chairman. The meeting this year will be held in connection with the Assn. of Southern Agricultural Workers.

The first day of the ESA meeting will include an address by Dr. B. A. Porter of Beltsville, Md., president of the Entomological Society of America. Also on the opening program will be the report of a committee that has been studying entomological curricula in the various institutions over the country. It will be presented by F. E. Guyton, Auburn, Ala. The afternoon of the first day's meeting will be devoted to papers on cotton insect research. A paper on resistance of the boll weevil to chlorinated hydrocarbons will be presented by J. S. Roussel and Dan Clower of the L.S.U. Agricultural Experiment Station. Other papers on cotton insects will be presented by leading entomologists from Alabama, Georgia, Arkansas, South Carolina, North Carolina, and Louisiana.

On the second day of the session, February 7, a series of papers on results of research on forest insects will be presented. Dr. R. Joseph Kowal of the Southeastern Forest Experiment Station, Asheville, N. C., will lead off with a discussion on progress and needs in forest insect research, survey, and control in the Southeast. On the same day a series of papers on insects of man and animals will be given. Highlight of this series will be a report on the present status of some major arthropod-borne diseases in the United States by R. C. Barnes, H. D. Pratt, and Roy Fritz of the U. S. Public Health Service, Atlanta. A group of three papers from the Alabama Agricultural Experiment Station reporting results of research on animal systemic insecticides should be interesting. On the same day a series of papers on insects of strawberries, sugar cane, corn, and peanuts will be given.

February 8, the final day of the meeting will be highlighted by the election of officers for the new year, but will also include research reports on a wide group of insects.

A. C. Young
Chairman
Cotton States
Branch of ESA

The program committee for the thirtieth annual meeting of the Cotton States Branch is composed of Drs. M. E. Merkl, Charles Lincoln, George D. Jones, R. P. Mullett, and D. O. Wolfenbarger. H. D. Purswell is in charge of local arrangements, assisted by Al Connelly, Al Wigger, Jim Maxwell, Ralph Barnes, and Bill Blasingame. G. Eden, Alabama Polytechnic Institute, Auburn, Ala., is secretary-treasurer of the section.

•

Okla. Fertilizer Conf. Feb. 15

The eleventh annual Crops, Soils, and Fertilizer Conference will be held in the Student Union, Oklahoma A. & M. College, Stillwater, Okla., Feb. 15-16. Featured at the meeting will be a report on the Agricultural Outlook for 1956, presented by Leonard F. Miller.

•

Phillips Pacific Ammonia Plant

Phillips Pacific Chemical Co. has purchased a 200-acre site in the Tri-Cities area of southeastern Washington where it will begin construction this spring of an ammonia plant. The site is 7 miles southeast of Kennewick on the west bank of the Columbia River, near Finley. The plant is scheduled for completion late in 1956. Using natural gas supplied by Pacific Northwest Pipeline Co. as raw material. It will have a daily production capacity of 200 tons of anhydrous ammonia.

•

New Hercules Sales Ofc.

Hercules Powder Co., Wilmington, has just opened a sales office under the Dallas district in Greenville, Miss. Leonard Edwards, who formerly worked out of the Dallas office, has been assigned to the territory which will be served by the new Greenville office.

R. E. Griffith, formerly extension entomologist and radio farm director of station KGBT, Harlingen, Tex., will be working with Mr. Edwards in covering this territory.

•

NPFI Award to Editors

Announcements of the second agricultural communications award, presented by the National Plant Food Institute and the American Association of Agricultural College Editors, have been sent to extension and experiment station editors and other key personnel at land grant colleges. The award consists of $500 presented by NPFI and an attractive scroll.

•

General Chem. Offers Miticide

A new organic miticide reported to control mites on apples, peaches, and other fruits, has been developed by General Chemical Division, Allied Chemical & Dye Corp., N. Y.

The company advises that the significance of the product for 1956 fruit spray schedules is evidenced by the fact that mites have become one of the most serious pest problems faced by commercial fruit growers in recent years, causting multi-million dollar losses in undersized, poor quality fruit.

Marketed under the trade-name, "Genite" EM-923, the new miticide is an organic chemical, 2,4-dichloro phenyl ester benzene sulfonic acid, with selective action.

Recommended for use on apples, peaches, pears, plums, prunes and almonds, Genite EM-923 has been tested at experiment stations in twenty eight states and three Canadian Provinces. For the past several years, it has been used by commercial growers in California with outstanding results. Tests have shown Genite EM-923 to be compatible with most pre-bloom spray materials, and it may be applied at any time from dormant to petal fall sprays.

According to a company spokesman, Genite EM-923 will be available this spring.

Potomac Meetings March 1-2

The two-day meetings of the Potomac Division of the American Phytological Society are set for March 1 and 2 at the Plant Industry Station, Beltsville, Maryland. Papers of general interest will be given in the morning and afternoon session March 1 and a market pathology symposium will be held the morning of March 2. This symposium will be moderated by Dr. Harold T. Cook, the Agricultural Marketing Service, and the speakers are: Dr. Cook, who will review the "History and Development of Market Pathology"; Mr. L. P. McColloch with the topic "Control of Market Diseases by Means Other Than Fungicides"; Dr. B. L. Smith speaks on "Control of Post-Harvest Diseases by Fungicides"; Dr. B. A. Friedman of the New York Pathology Laboratory will discuss "Market Diseases in a Large City Market"; and Mr. W. H. Redit will speak on the topic "Transportation Problem in Relation to Post-Harvest Market Diseases". There will be a demonstration of equipment used in transportation tests.

The annual banquet will be held the evening of March 1 in the St. Andrews Episcopal Church, College Park, Maryland. An interesting and entertaining program for that evening has been arranged under the direction of Dr. W. Q. Leegering.

Programs may be obtained from Dr. L. O. Weaver, secretary and treasurer, Department of Plant Pathology, University of Maryland, College Park, Maryland.

•

IMCC Expansion in Fla.

A multi-million dollar expansion program, expected to double the production capacity of its Bonnie plant near Bartow, Florida, was announced by International Minerals and Chemical Corp. The Bonnie plant is the major unit of the corporation's Phosphate Chemicals Division and manufactures triple superphosphate and feed grade dicalcium phosphate.

International has appropriated four million dollars for the first step in this program which is to include a second sulfuric acid plant and new equipment for the neutralization and recovery of plant effluents. When this expansion is completed, the Bonnie plant will be able to produce 500,000 tons of product annually.

•

Conahan On NPFI Staff

Lee Conahan joined the staff of the National Plant Food Institute, Washington, D. C., on January 23

Lee Conahan joins NPFI editorial staff.

as an editorial assistant. He succeeds Peter C. Crolius who left NPFI recently to join the staff of the Nitrogen Division, Allied Chemical & Dye Corporation.

In his new position, Mr. Conahan will assist in editing the weekly *News Report* to NPFI members, and NPFI's quarterly magazine, *Plant Food Review*. He also will assist in editing and producing special publications for the Institute.

•

Mosquito Experts Meet Mar. 7

The 43rd Annual Meeting of The New Jersey Mosquito Extermination Association will be held at Hotel Haddon Hall, Atlantic City, N. J., March 7-9. The program for the meeting will include discussions on the influence of changing climate and ground water conditions on mosquito activities. Dr. Bailey B. Pepper, Rutgers University, reports that the program will include also a review of recommendataions of the state mosquito control study commission which last fall investigated mosquito control in New Jersey.

•

Arkell & Smiths Names Masoner

Robert C. Masoner has just been appointed central division sales manager of Arkell and Smiths, multiwall bag manufacturers. Mr. Masoner has been associated with the bag business for the past thirteen years and has been with Arkell and Smiths, as a salesman in the Ohio territory, for the past year and a half. His offices will be in Columbus, Ohio.

Rohm & Haas Branches Move

Removal of its San Francisco office to the new Pacific Mutual Building, 600 California Street, is announced by Rohm & Haas Co., Philadelphia. The office is in charge of the company's Pacific Coast manager, K. L. Jopke. Dr. L. L. Isenhour is the representative for agricultural and sanitary chemicals.

The company also has moved its Atlanta office to a new location at 1428 West Peachtree Street, N. W.

•

USDA Seizes NYC Lettuce

Two carloads of lettuce were seized by U. S. marshals in New York City on charges by the Food and Drug Administration that they were contaminated with the insecticide endrin. Use of endrin is not permitted on this crop.

The lettuce was shipped from El Centro, Calif. It was from a 40-acre field which was left unharvested after FDA inspectors had sampled the first two cars.

Commissioner Larrick warned growers and all others concerned with processing and shipping of food crops that directions appearing on pesticide labels should be followed carefully. "Agricultural dusts and sprays should be used only on the *crops* specified, at the *times* specified, and in the *amounts* specified," he said.

"Growers do not have excessive spray residues on their crops when they observe proper precautions in using agricultural sprays and dusts, but misuse of such chemicals can leave poisonous residues that make a crop illegal in interstate commerce," the Commissioner said.

•

Armour Appoints Wooten, Jr.

Armour Fertilizer Works announce that F. L. Wooten, Jr. has been transferred to the general office in Atlanta in the capacity of unit sales manager. Mr. Wooten was formerly manager of the firm's Wilmington, North Carolina, division. Succeeding Mr. Wooten as division manager at Wilmington is J. H. Pate. Mr. Pate, a North Carolina State graduate, was formerly assistant manager at the Armour Fertilizer Works Division at Norfolk, Va.

Western Weed Conferences in Sacramento Feb. 15-16

WESTERN and California experts on weed control will gather in Sacramento, Feb. 15 and 16 and at the University of California airport in Davis, February 17 to direct their attention to the broad problem of weed control in all its phases.

As an example of one phase of weed control and its importance, an official of the United States Department of Agriculture states that water losses due to weeds in an irrigation system amounted to two per cent of the total water supply available. Applied to California's present water supply, this rate of loss would indicate that 400,000 acre feet of water is lost annually in California due directly to the presence of weeds in unlined irrigation canals. Carried further, the 400,000 acre feet of water lost would be sufficient to irrigate an additional 140,000 acres of land, with an estimated crop value of $40,000,000. It would require another Folsom dam to offset such a loss unless a vigorous weed control program was to be initiated in the state's irrigation systems.

Weed control on the national and international fronts will be the theme for the opening discussions February 15. With Walter S. Ball, of Sacramento, president of the Western Weed Control Conference presiding, the discussion lead off men will be W. W. Allen, Dow Chemical Co., Midland, Mich.; Henry Wolf, Washington State College, Pullman, Washington; D. Watkins, Ivon Watkins Chemical Co., New Plymouth, New Zealand; Arne Carlson, E. I. Du Pont de Nemours and Co., Wilmington; E. G. Anderson, Secretary, National Weed Committee, Ottawa, Canada.

Presiding officer at the first day's afternoon session will be Boysie Day, University of California, Riverside. California director of agriculture, W. C. Jacobsen, will introduce Goodwin J. Knight, Governor of California. Governor Knight's address will be followed by the reports of the research committee, Western Weed Control Conference.

A panel discussion of the question "What is New in Weed Control" is slated for the evening session.

Gov. G. J. Knight
Governor of Calif.

W. C. Jackson
Calif. Dir. of Agr.

Robert Underhill, Dow Chemical Co., San Francisco, will moderate. Panelists will include Robert Beatty, American Chemical Paint Co., Ambler, Pa.; Arthur O. Jensen, American Cyanamid Co., Oakland, Calif.; J. R. McCambridge, Chipman Chemical Co., Portland, Ore.; D. W. Rake, Pacific Coast Borax Co., Los Angeles, R. N. Raynor, Dow Chemical Co., San Francisco; Lyall F. Taylor, Du Pont Chemical Co., San Francisco; Ely Balgley, Heyden Chemical Co., New York City; Robert J. Zedler, Carbide and Carbon Chemical Co., Yonkers, New York; Joe Antognini, Stauffer Chemical Co., Mountain View, Calif.; K. E. Maxwell, Monsanto Chemical Co., Santa Clara, Calif., and Vern W. Olney, Geigy Co., Inc., Fresno, Calif. Allen B. Lemmon, California Department of Agriculture, will discuss the Miller Bill with respect to the California Pesticide Act.

•

CFA Program For Trainees

In an effort to promote the complete education of as many promising students of the agricultural sciences as possible, the California Fertilizer Association addressed letters to the 237 instructors of vocational-agriculture in the high schools and junior colleges of California.

The letter calls attention to the growing shortage of qualified agronomists, entomologists, chemists and other technicians so vitally important to agricultural progress. It points out the fact that our standard of living is concerned in a major way.

All high school and junior college instructors of vocational-agriculture are urged to use their strongest influence upon their promising students and their parents to assure the completion of their technical educations. This program, if successful, will fill many gaps in the ranks of qualified agricultural technicians, the Association says.

The letter concludes with the promise of the Association to assist in placing in the commercial fertilizer industry those who are qualified through education, aptitude, and inclination.

•

Lion Opens New Iowa Office

Lion Oil Co., a division of Monsanto Chemical Co., has opened new chemical sales offices in Des Moines, Iowa, and moved the Montgomery, Ala., chemical sales offices to Atlanta.

The new offices at Des Moines are under the management of George C. Kempson, formerly assistant manager of the Montgomery sales office. The Des Moines office will head what has been designated as the midwestern sales district.

Lion's newly-established southeastern district sales offices in Atlanta are under the direction of R. S. Johnson.

•

New Greek Fertilizer Plant

Hellenic Co. of Chemical Products and Fertilizers, Ltd., Greece, has increased chemical fertilizer output at their Piraeus plant from 60 to 100 tons per day. A new 100 ton plant, presently producing ammonium phosphate, designed by Dorr-Oliver Inc., Stamford, Conn., to manufacture either triple superphosphate or ammonium phosphate, has replaced a 60 ton triple superphosphate installation designed by the same company and initially put into operation in 1934. Evidence of recent advances in technology of fertilizer plant design is the reduced floor space required by the new plant - only one-quarter to one-third that of its predecessor.

QUALITY
CONTROLLED

PHOSPHATES

YOUR PHOSPHATE
IS ANALYZED 5 TIMES BEFORE SHIPMENT

Careful testing of your phosphate at every stage of production —washing, blending, drying, grinding and loading—is one of the factors in *International's* quality control that assures uniformity of grade to exact specifications. Your phosphate is sampled and tested in our analytical laboratory at least five times before shipment. Blending grades to your special requirements is simple routine because of our large tonnage and the flexibility of our modern production facilities. When you depend on *International* for phosphates, our great team of mining, production and service people sees to it that you get exactly what you order, in the tonnage you need, when you want it. That's what quality control means.

FOR INDUSTRY AND AGRICULTURE

- for the manufacture of complete fertilizers.
- for the manufacture of industrial chemicals.
- ground rock phosphate for direct application to the soil.

PHOSPHATE MINERALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

GENERAL OFFICES: 20 N. WACKER DR., CHICAGO 6 • Phosphate Mines and Plants in Florida at Noralyn, Peace Valley, Achan, Mulberry; in Tennessee at Mt. Pleasant and Wales

SPOTLIGHTING PENCO®

HIGH GAMMA BHC Technical

PENCO High Gamma BHC Technical—averaging 16% gamma isomer—from Penn Salt's Calvert City, Kentucky, plant, has these advantages!

- More versatile and economical to process by dissolving, impregnating and grinding.
- More highly concentrated dust bases, wettable powders and liquids can be produced.
- Less material to store, handle and process.
- Higher quality cotton dust can be formulated for application by air or ground equipment.

PENCO BHC Technical—averaging 14% isomer—available in flake form—ideal for easy grinding—extending into dust bases—finished dusts.

For superior, high-quality products select PENCO Agricultural Chemicals.

PENCO®

"Technical BHC with a difference"

Write TODAY for our new Technical Bulletin No. A-7

Pennsylvania Salt Manufacturing Company of Washington

Tacoma 1, Washington

Portland, Ore.; Berkeley, Los Angeles, Calif.; Bryan, Texas; Montgomery, Ala.; Aurora, Ill.

Pennsalt Chemicals

New laboratories opened at Nakuru, Kenya by the Pyrethrum Board of Kenya.

Dr. Ulrick Kroll, Department of Agriculture (left) shows newly developed pyrethrum flowers to N. H. Hardy, Pyrethrum Board of Kenya at pyrethrum station in Molo, Kenya.

Pyrethrum Research Laboratory in Kenya

A NEW laboratory for research on pyrethrum was opened late in 1955 in Nakuru, Kenya Colony, in East Africa. Built, equipped and maintained by the Pyrethrum Board of Kenya, the new $100,000 research set-up will be devoted to finding the answers to a series of fundamental questions about pyrethrum and its mode of toxic action on insects. Typical questions to which the laboratory staff are currently seeking to find the answers are listed as follows:

1. What is its basis?
2. What breeding means can best be used to increase the pyrethrin content of the flowers which are necessarily expensive to grow and to harvest by hand?
3. How can flower volume be increased with full preservation of the pyrethrin content?
4. How can the breeding of new strains be used to improve the biological activity of the plant?

As an insecticidal raw material, pyrethrins, extracted from pyrethrum, a daisy-like flower, offer the advantage of complete safety to warm-blooded animal life including humans. Also insects develop no immunity to pyrethrum as they do to many of the chlorinated hydrocarbon insecticides. The U. S. insecticide industry will use about 100,000 pounds of pyrethrins in 1955, approximately 65% of world production. By 1960, U. S. demand may well increase to 200,000 pounds.

This research center in the Kenya colony is in addition to experimental stations in pyrethrum flower culture operated by the governments of British East Africa and the Belgian Congo. Being located so near flower growing areas, it is possible for laboratory workers to grind flower samples taken direct from current warehouse deliveries, with careful checking of superior strains and points of origin. A note of special interest to entomologists is that insects similar to those which infest America, Europe and other geographical areas must be bred in Kenya for biological test work.

Again, because of closeness to the growing areas, laboratory results can be translated immediately into field work.

New Lummus Research Center

The Lummus Co., designing engineers and constructors for the petroleum and chemical industries, will establish early in 1956 an Engineering Development Center in Newark, N. J. Lummus has purchased for the center a 150,000 sq. ft. building on a ten and one half acre plot near the Newark Airport.

Lummus, which has had similar facilities in Bayonne, New Jersey for the past 25 years, will use the new building primarily for pilot plant operation and process development work.

•

Open Pit Boron Mining

Start of open pit mining, major step in the $18,000,000 development of a sodium borate deposit for Pacific Coast Borax Co., went into effect at Boron, Calif. early this year.

Inaugurating the conversion from 30 years of shaft-tunnel operations. J. M. Gerstley, president of the Pacific Coast Borax Co., a division of Borax Consolidated, Limited, said the project, including construction of new refining and concentrating plants, is expected to be completed next year.

•

To Build Sulfuric Acid Plants

Chemical Construction Corp., a unit of American Cyanamid Co., announced in January agreements with two firms, one to design and equip a sulfuric acid plant in Arizona, the other to construct a similar unit in Canada. A 100 tons per day contact sulfuric acid plant using as raw material roaster gas from roasting operations will be built at Hayden, Ariz. A 75 tons per day contact sulfuric acid plant will be located at Shawinigan Falls, Quebec.

•

R. M. Hersey Bemis V. P.

R. M. Hersey has just been elected vice-president of Bemis Bro. Bag Co. Mr. Hersey, who is a director and sales director for national accounts, has his headquarters in Minneapolis. He has been with Bemis since 1914 and has had extensive sales experience in all segments of the bag industry.

For better wettable powders
-USE

IGEPON

to help fight farm pests

IGEPON T-77

IGEPON T-73

IGEPON AP-78

IGEPON T-77, T-73 and AP-78 are particularly recommended for the formulation of dry mixtures of wettable biocidal powders because they can be ground in without objectionable caking and also because they give your products the added advantage of —

Faster Wetting • *Stable Dispersion* • *Controlled Foaming*

in either hard or soft water. Let us recommend the IGEPON which is best suited to your particular requirement.

IGEPONS can be used in herbicides and insecticides including DDT, 2,4-D, 2-4-5-T, BHC, Lindane, Chlordane, Dieldrin, IPC, Potassium Cyanate, Parathion, Aldrin, Sulfur, and Toxaphene.

You can do it better with an IGEPON

Write today for our new brochure on the complete IGEPON line.

From Research to Reality

ANTARA CHEMICALS

A SALES DIVISION OF GENERAL ANILINE & FILM CORPORATION

435 HUDSON STREET · NEW YORK 14, NEW YORK

SALES OFFICES: New York • Boston • Providence • Philadelphia • Charlotte • Chattanooga • Chicago Portland, Ore. • San Francisco • Los Angeles • IN CANADA: Chemical Developments of Canada, Ltd., Montreal

ANTARA

gaf

Preliminary Report Shows 1.3% Drop in Fertilizer Consumption

CONSUMPTION of commercial fertilizer in the United States for the year ended June 30, 1955, was estimated at 22,468,000 tons, a decrease from 1953-54 of 1.3% or 305,000 tons, in a preliminary report on Commercial Fertilizer and Primary Plant Nutrient Consumption in the U. S., prepared by Walter Scholl, Hilda M. Wallace and Esther I. Fox, and released last month by the Soil and Water Conservation Research Branch, Agricultural Research Service, U.S.D.A., Beltsville, Md. Though tonnage of commercial fertilizer showed a decrease during this period, the estimated quantity of plant nutrients contained in the fertilizers consumed continued to gain. The primary nutrient total for the 1954-55 year was 6,047,000 tons, which was 151,000 tons or 2.6% more than in the 1953-54 crop year.

Consumption of commercial mixtures in the 54-55 crop year was estimated at 15,151,000 tons, a decrease of 390,000 tons or 2.5% from the previous year; while materials for direct application showed a gain in 54-55, the total being 7,317,000 tons, which was 1.2% or 85,000 tons more than the figures for the 53-54 crop year. One of the most striking changes percentagewise was the big increase, 27.5%, in consumption of secondary and trace element materials, during the 54-55 crop year. This figure was upped from 615,000 tons in the previous year to 785,000 tons, with the increase being due primarily to the increased use of gypsum in the Pacific region.

The largest decrease in tonnage in both mixtures and materials was in the East North Central region, the decline in use of direct application materials being largely traceable to the decreased use of phosphate rock for direct application. Use of both mixtures and materials increased in the New England region, with the increase in materials being a reflection of the return to superphosphate for direct application. In the Middle Atlantic and East South Central regions, the tonnage of phosphates for direct application was generally lower than in 1953-54. The relatively high percentage increase in tonnage of materials in the Pacific region was, aside from the increased tonnage of gypsum, due primarily to the increase in tonnage of anhydrous, and in particular, aqueous ammonia.

Consumption of primary nutrients supplied by mixed fertilizers was estimated to be 4,203,000 tons in 1954-55. This total comprises 814,000 tons of nitrogen, 1,776,000 tons of available P_2O_5, and 1,613,000 tons of K_2O. These figures represent 4.6 percent more nitrogen, 1.4 percent less available P_2O_5, and 1.1 percent more K_2O than those for 1953-54. Materials used for direct application supplied 1,170,000 tons of nitrogen, 453,000 tons of available P_2O_5, and 221,000 tons of K_2O. These tonnages represent increases in nitrogen of 9.4 percent; available P_2O_5, 2.8 percent, and K_2O, 5.2 percent above those for 1953-54.

Nitrogen showed a nation-wide increase, which reflects the current trend towards higher-nitrogen fertilizers. The average nitrogen content of

TABLE 1
Preliminary Fertilizer Consumption in U. S., Year Ended June 30, 1955, with Comparisons

Region	Consumption*			Per cent change from 1953-54		
	Mixtures	Materials†	Total	Mixtures	Materials	Total
	1,000 tons			Per cent		
New England	373	79	452	+6.0	+22.1	+ 8.5
Middle Atlantic	1,882	217	2,099	+2.4	— 6.0	+ 1.5
South Atlantic	4,922	1,149	6,071	—2.0	+ 2.5	+ 1.2
East North Central	3,371	1,031	4,402	N6.9	—14.2	— 8.7
East South Central	1,283	905	2,188	—4.5	+ 2.7	— 1.7
West South Central	1,983	910	2,893	—2.8	— 7.5	— 4.3
West North Central	704	659	1,363	—1.3	— 3.3	— 2.3
Mountain	544	339	393	—3.3	+ 0.7	+ 0.1
Pacific	297	1,897	2,194	+8.9	+18.4	+17.0
Continental U. S.	14,869	7,186	22,055	—2.6	+ 1.2	— 1.4
Territories	282	131	413	—0.4	+ 1.7	+ 0.2
Total: 1954-55	15,151	‡7,317	22,468	—2.5	+ 1.2	— 1.3
1953-54	15,541	‡7,232	22,773	0.0	0.0	0.0
1952-53	15,722	‡7,690	23,413	+1.2	+ 6.3	+ 2.8

*Includes fertilizers distributed by government agencies. †Includes: Ground phosphate rock and colloidal phosphate, basic slag, secondary and trace element materials, such as borax, metallic salts, sulfur, gypsum, etc., used as separate materials. Does not include liming materials or the quantity of materials used for manufacture of commercial mixtures. ‡Materials not guaranteed to contain N, P_2O_5 or K_2O included in 1954-55 total, 785,000 tons; 615,513 tons in 1953-54; and 877,487 tons in 1952-53. New England—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut; Middle Atlantic—New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, West Virginia; South Atlantic—Virginia, North and South Carolina, Georgia, Florida; East North Central—Ohio, Indiana, Illinois, Michigan, Wisconsin; West North Central—Minnesota, Iowa, Missouri, North and South Dakota, Nebraska, Kansas; East South Central—Kentucky, Tennessee, Alabama, Mississippi; West South Central—Arkansas, Louisiana, Oklahoma, Texas; Mountain—Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada; Pacific—Washington, Oregon, California; Territories—Hawaii, Puerto Rico, Alaska.

TABLE 2
Estimated Content of Primary Plant Nutrients in All Fertilizers Consumed in U. S., Year Ended June 30, 1955, with Comparisons

	Quantity Available				Per cent change from 1953-54 Available			
	N	P_2O_5*	K_2O	Total	N	P_2O_5	K_2O	Total
	1,000 tons				Per cent			
New England	29	48	47	124	+15.9	+13.9	+ 9.3	+12.6
Middle Atlantic	123	230	195	548	+11.5	— 1.6	+ 6.1	+ 3.8
South Atlantic	398	472	485	1,355	+ 4.1	— 4.0	+ 4.8	+ 1.4
East North Central	282	539	576	1,397	+ 8.1	— 1.5	— 3.0	— 0.4
West North Central	298	355	162	815	+12.0	+ 4.8	+ 4.7	+ 7.3
East South Central	271	254	213	738	+ 2.9	— 6.7	— 0.6	— 1.6
West South Central	192	252	82	426	+ 5.8	+ 5.0	— 4.3	+ 3.6
Mountain	68	57	3	128	+ 3.6	— 3.2	+28.3	+ 0.8
Pacific	265	101	31	397	+12.8	+ 9.5	+12.8	+11.9
Continental U. S.	1,926	2,208	1,794	5,928	+ 7.6	— 0.6	+ 1.5	+ 2.6
Territories	58	20	41	119	+ 0.9	— 0.7	+ 3.3	+ 1.4
Total: 1954-55	1,984	2,228	1,835	6,047	+ 7.4	— 0.6	+ 1.6	+ 2.6
1953-54	1,848	2,242	1,806	5,896	0.0	0.0	0.0	0.0
1952-53	1,737	2,271	1,738	5,646	—11.4	+ 1.3	— 3.8	— 4.2

*Includes, as available P_2O_5, 2% of the colloidal phosphate and 3% of the phosphate rock marketed for direct application.

Be Certain - Be Safe

WITH

African Pyrethrum

Nature's own insecticide base that — of all the list — is toxic to insects and harmless to human and to animal life.

PYRETHRUM for quick knock-down is unsurpassed.

PYRETHRUM required for insects resistant to insecticides.

PYRETHRUM used in low concentrations with synergists is powerful, deadly and certain.

PYRETHRUM used in aerosol bombs, with mechanical fogging devices and with usual spray equipment gives greatest economy with fullest protection, rapid dispersal and high penetration.

PYR

AFRICAN PYRETHRUM

There is no substitute for AFRICAN PYRETHRUM — produced and constantly improved in the fields and research stations of Africa.

FOR THE BEST FINISHED INSECTICIDE . . . . USE THE BEST BASE

Use:

African Pyrethrum

African Pyrethrum Development, Inc. 65 Pine Street, New York 5, N. Y.

mixed fertilizers was 5.4 percent, and of primary nutrient materials 17.9 percent, compared with 5.01 percent and 16.16 percent, respectively, in 1953-54.

•

IMCC Personnel Changes at Fla.

James F. Roe has been advanced to manager of the Florida operations of the Phosphate Chemicals Division of International Minerals & Chemical Corp., and Charles A. White has been advanced to manager of the division's Tennessee operations.

IMCC announced also the advancement of Robert V. Safford to assistant manager of the division's Florida operations and Ralph W. Lorentz to plant superintendent of the division's Bonnie plant, near Bartow, Florida.

Bryce L. Rhodes has been appointed to products and by-products production staff member for the Phosphate Chemicals Division.

•

Southern Weed Meeting,

The Ninth Annual Southern Weed Conference was held January 16-18 at the Jung Hotel, New Orleans, La. Several hundred representatives of the USDA, agricultural chemical manufacturers, Southern land-grant colleges, farm equipment manufacturers and farmers from over the South attended the three day conference.

G. C. Klingman, North Carolina State College, presided at the opening session, and presented a report on "Future Prospects for Chemical Weed Control in the South". During that same session a panel review of "Efficient Weed Control—A Common Cause" included several reports on application of herbicides and results in numerous experiments and field trials. Weed problems of particular interest to the Southern states were discussed, with special emphasis being placed on weed control in cotton, tobacco, horticultural crops, grasses and forage.

D. E. Davis, Alabama Polytechnic Institute, Auburn, presented data on the variability in tolerance of DNOSBP by eight economic crops. R. E. Stamper, Louisiana Agricultural Experiment Station, offered progress reports and studies on weed and grass control in sugar cane in Louisiana.

Some 80 discussions on herbicides and herbicide applications included discussions of granular car mix in oakwood land, and control of mesquite; weed control in oats, soybeans, brush; control of Johnson grass, etc.

Reports of research committees provided a basis for 1956 recommendations.

•

Union Bag Advances Jacobi

Union Bag & Paper Corp. announced the appointment of William F. Jacobi as director of its newly

W. F. Jacobi

created package engineering department. This department consolidates the company's packaging services and packaging machinery department. John F. Hordych has been appointed assistant director of the department.

•

Stauffer Reveals PO_3 Deposit

Stauffer Chemical Co., New York, report that large mineable deposits of high grade phosphate rock exist on its patents near Bear Lake, Idaho. Reserves in the deposits are estimated at over 5,000,000 tons of commercial grade phosphate rock. Total cost of development of the project is estimated at $400,000.

•

Chipman Canadian Offices

Chipman Chemicals Ltd. announced plans to establish its central administrative offices in Hamilton, Ont. J. G. Hastings will be general and eastern sales manager, L. M. Godfrey, development and technical service manager, and W. P. Dean, is railway service and production manager.

Tennessee Dealer Meetings

Seed and fertilizer dealer meetings, which will cover both the present situation and the outlook for the 1956 crop year, will be held across Tennessee Feb. 7-10, sponsored by the University of Tennessee Agricultural Extension Service and State Department of Agriculture. Places and dates of the four meetings follow:

Nashville, Andrew Jackson Hotel, February 7.

Jackson, City Hall, February 8.

Athens, Administration building, Tennessee Wesleyan College, February 9.

Greeneville, Assembly room, King Arthur Court, February 10.

L. C. Jacobs, superintendent, division of feed, seed and fertilizer, State Department of Agriculture, will preside at the meetings. Leading the various discussions will be: Lewis H. Dickson, U-T Extension associate agronomist, on the seed situation; W. H. Garman, chief, agronomic relations, National Plant Food Institute, fertilizer situation; W. D. Bishop, U-T Extension associate agronomist, and Webster Pendergrass, U-T Extension agronomist, on using fertilizer, lime in crop production; L. N. Skold will discuss field crop varieties for Tennessee.

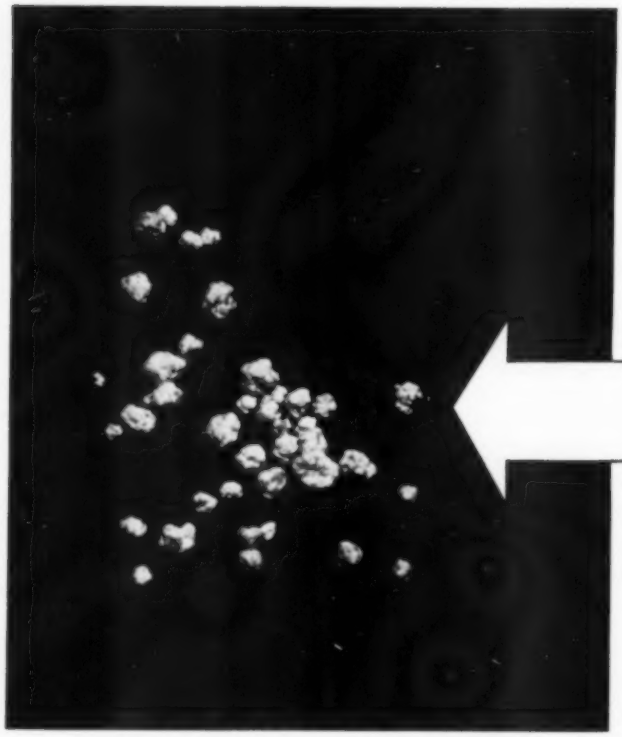
A film, showing the development and production of certified seed, will be featured. A panel discussion, with J. R. Turner, agronomist with the Pacific Coast Borax Company as mediator, and local dealers as participants, is also on the program.

•

McCallum Joins Huber

Laurice W. McCallum has been appointed technical sales representative for J. M. Huber Corp. in the southeast. Mr. McCallum will represent the company's industrial products department in its sales of clays, carbon blacks and chemicals to the rubber, paper, ceramics, pesticides and other industries. His headquarters will be in Huber, Georgia.

Mr. McCallum was formerly with Gates Rubber Co. and B. F. Goodrich Co.



HAVE YOU SEEN BHC IN THIS SHAPE?

Stauffer BHC Pellets Shown in Actual Size

You probably haven't! Stauffer BHC is the first to be marketed in pellet form. It's also the only BHC available in 24-gamma isomer. There's twice as much kill per pound.

Stauffer BHC pellets have solved your BHC grinding problem!

Cold weather or hot, dry or humid, Stauffer pellets grind up like fertilizer. What's more . . . you get all you pay for: it doesn't stick to the box or cake in the corners.

Stauffer BHC pellets are easy to handle. They are virtually dust-free. Easy to store and measure.

Available for immediate shipment to all sections of the country. Write to us for complete information.

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL COMPANY

380 MADISON AVENUE, N. Y. 17, N. Y.

SAN FRANCISCO • OMAHA • LOS ANGELES
WESLACO • LUBBOCK • HARVEY
NO. LITTLE ROCK • TAMPA • NO. PORTLAND

Entomology Congress in '56

The 10th International Congress of Entomology is scheduled to be held in Montreal, Canada August 17-25, 1956. The meeting is expected to attract some 4-5,000 entomologists, insecticide manufacturers, representatives of experiment stations, etc. from all over the world.

Reports are still being submitted for presentation at the meeting. Some of the interesting reports scheduled for the conference include the following:

"Insecticide application to row and field crops," James Brann, U.S.A. "High altitude application of insecticides from aircraft," Mr. Hurtig, Canada. "Recent developments in spraying techniques," H. G. Kearns, England. "Development of concentrate spraying for deciduous fruits," James Marshall, Canada. "The comparative assessment of locust control methods," R. C. Rainey, England. "General reveiew of dust diluents and some of the technical aspects which affect insecticide application," D. Weidhaas, USA.

"Recent progress in the development of procedures for erdicating or controlling tropical fruit flies," L. D. Christenson, Hawaii. "Recent advances in control of temperate climate fruit flies," B. A. Porter, U.S.A. "Insect resistance to insecticides," R. L. Patton, U.S.A.

Legal insecticide tolerances and their effect on world agriculture.

"Problems of forest aerial spray, dispersal and assessment," J. J. Fettes, Canada. "Spruce budworm control in Oregon and Washington, 1949-1955," J. M. Whiteside, U.S.A. "Biological assessment of aerial forest spraying against the spruce budworm in New Brunswick," F. E. Webb, Canada.

Insect problems in forest plantations: "Upsurge of pests in Michigan pine plantations," S. A. Graham, U.S.A.

•

McAusland of Bemis Retires

R. D. McAusland, director of Western Operations for Bemis Bro. Bag Co., Seattle, will retire on January 30. He is a vice-president and a director of the company. L. A. Linville, assistant director of sales at the Bemis general offices in St. Louis, has been named to succeed Mr. McAusland as director of Western Operations.

•

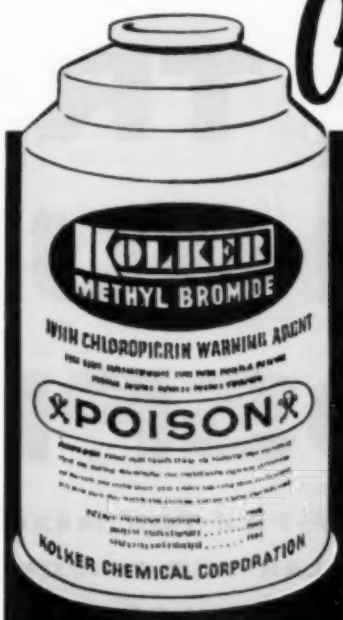
Nott Campaign to Consumer

A large spring consumer advertising campaign has been scheduled by Nott Manufacturing Co., Mount Vernon, N. Y., for two of its lawn weed killer products, "Artox Special" and "Artox Standard." More than 300 ads in principal local markets will be starting soon on these lawn weed killers.

"Artox Standard" is now available in powder and liquid form. Nott claims that their "Artox Special" is the only lawn weed killer containing both di sodium methyl arsonate and 2,4-D.

S. C. Pesticide School Feb 28-29

The fifth annual Pesticide Chemicals School is scheduled for February 28-29 at the Clemson House, Clemson College, Clemson, S. C. The meeting will be of particular interest to pesticide manufacturers, formulators, dealers, and salesmen; aerial applicators, pest control operators, county agents, agricultural vocational personnel, research and extension personnel.



Announcing

KOLKER METHYL BROMIDE

Now being produced at our modern plant in Newark, N.J., Kolker Methyl Bromide is the outstanding fumigant for the elimination of insect and rodent infestation of grain, tobacco plant beds, seeds, dried fruits, cereals, nursery stock and a wide variety of other products.

KOLKER METHYL BROMIDE

- Kills insects, mites and related pests in all stages of their development.
- Has a high degree of toxicity to a wide range of insects, rodents and other pests.
- Has rapid volatilization and a high rate of diffusion into stored grain, bales, packages and soil.
- Is non-explosive and non-flammable.
- Does not leave any residual odors, tastes or stains.
- Is economical to use.

Kolker Methyl Bromide is packaged in regular one-pound cans with 2% chloropicrin as warning agent, and 125, 150 and 450 pound cylinders of 100% methyl bromide.

Sale of Kolker Methyl Bromide will be handled by distributors throughout the country.

For further information on this highly effective fumigant, please call or write us today.

KOLKER CHEMICAL CORPORATION
600 Doremus Ave. · Newark 5, N. J. · MArket 2-4085

TENNESSEE CORPORATION

TRIPLE SUPER-PHOSPHATE

1. RUN-OF-PILE FOR MAXIMUM AMMONIATION
2. GRANULAR FOR DIRECT APPLICATION
3. PROMPT SERVICE TO MEET EVERY REQUIREMENT

Superior phosphate fertilizers have been produced for nearly 30 years. This unequalled experience is your assurance of quality and dependability in Triple Superphosphate. To plan your shipments for maximum satisfaction, call upon your Bradley & Baker representative today.

U.S. PHOSPHORIC PRODUCTS
Division TENNESSEE CORPORATION Tampa, Florida

Sales agents: **BRADLEY & BAKER**
155 EAST 44th STREET • NEW YORK 17, N. Y.

District Sales Offices: ATLANTA • INDIANAPOLIS
ST. LOUIS • NORFOLK • HOUSTON

Dr. Helen Hart Named New Head of A.P.S.

S. E. A. McCallan, Boyce Thompson Institute; George W. Fischer, president-elect, Washington State College; Glenn S. Pound, secretary, University of Wisconsin; Helen Hart, president, University of Minnesota; Paul R. Miller, vice-president, Plant Disease Epidemics, U.S.D.A., Beltsville, Maryland; Saul Rich, treasurer and business manager, Connecticut Agricultural Experiment Station.

DR. HELEN HART, University of Minnesota, became president of APS, succeeding Dr. James H. Jenson, Iowa State College, at the 47th annual meeting of the American Phytopathological Society in Atlanta held Dec. 27-30. Other new officers are Dr. George Fischer, Washington State College, president-elect; Dr. Paul R. Miller, U. S. Department of Agriculture, vice-president, and Dr. S. E. A. McCallan, Boyce-Thompson Institute, councilor.

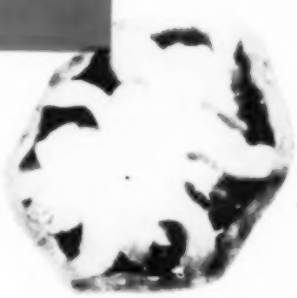
More than 500 members and guests attending the meeting heard a discussion of the Miller Amendment by W. B. Rankin, assistant to the Commissioner of the Food and Drug Administration. Mr. Rankin said that under this new pesticide-regulating amendment, all fungicides will fall into one of four classifications: 1. Chemicals that are not considered poisonous as used on crops; 2. Chemicals that are considered poisonous, but are used in agriculture so that residues do not present any foreseeable hazard to man; 3. Fungicides that are poisonous, but still are safe enough for small residues to remain in or on food without endangering the public health; and 4. Chemicals that have a zero tolerance or its equivalent. Any compound not covered in one of the first three groups will have the equivalent of a zero tolerance when the law becomes fully effective. The amendment will become effective for all fungicides next July. (See page 37 for complete report of Mr. Rankin's address.)

A description of industry's part in meeting this country's fungicide needs was offered by Gordon A. Brandes, in charge of research and development for Rohm and Haas Co., Philadelphia. He listed industry's contribution as: assuming the main responsibility for exploratory work on new fungicides, including synthesis and preliminary laboratory and field screening to determine the product's potential; cooperating with government in conducting more exhaustive field tests, and facilitating this cooperation through technical development personnel, working closely with government personnel; being morally obligated to produce a safe-to-use material and legally obligated to qualify this material under existing laws as administered by the FDA and USDA; being equipped to manufacture, market, promote, and sell these fungicides, and continuance of attempts to convince practical farmers, government administrators, and corporation executives of the importance and necessity of fundamental research. Otherwise, he said, "applied research will eventually reach the dead end of a one-way street." Brandes said that although the development of fungicides (and some other pesticidal chemicals) is frequently more costly than the development of other chemical products, it is important that industry engage in this work because better fungicides add up to a more prosperous agriculture and a resultant better market for all agricultural chemicals. (Mr. Brandes complete address will appear in *Agricultural Chemicals* March issue.)

A sharpening of the total nematode picture by significant contributions of several research scientists featured the invitational address by Dr. J. N. Sasser of North Carolina State College. Dr. Sasser offered several targets, accession to which he believed would vastly improve control of these Johnny-come-lately plant pests. One goal, he emphasized, is the development of a systemic nematocidal chemical that can be absorbed by the foliage of plants and translocated to the roots to prevent or eradicate nematode infection. His other suggestions were: Determine which of the plant-associated nematodes are pathogenic and the nature of their parasitism, the type of damage they do, their action in pre-disposing plants to attack by other diseases, and the role of ecology in nematode activity; how fumigants kill, and what are the best conditions for fumigant use. Fulfilling some of these needs through research, Dr. Sasser believes, will permit the fullest use of chemicals, resistant plants, and cultural methods against the nematodes. (More detail on Dr. Sasser's remarks is provided in a summary elsewhere in this issue. See page 61.)

Pursuing the nematode problem, another North Carolina State College pathologist, J. L. Allison, reported that he had found a difference in susceptibility to the root knot nematode in varieties of alfalfa and sericea lespedeza. These differences, he said, may be a clue to the development of nematode-resistant legumes through plant breeding.

In this vein, Dr. W. W. Hare of the Mississippi Agricultural Experiment Station announced progress toward the development of a commercial bell pepper with resistance against the root knot nematode. Dr. Hare found four hot peppers to be resistant to all known kinds of these root knot nematodes in the South, and also found this nematode-resistance to be controlled by a single dominant gene. He believes it will be possible to transfer the nematode re-



without sufficient potash

IN TOMATOES, POTASH-ENRICHED FERTILIZERS MAKE THE DIFFERENCE

with sufficient potash

Balanced fertilizers are essential to the maintenance of rich soil needed to grow healthy, vigorous, profitable crops. Potash is an indispensable partner in these balanced fertilizers, because it promotes plant resistance to disease, while increasing both the yield and the quality

U. S. P.'s high grade muriate of potash has the highest K_2O content and is free-flowing and non-caking—important advantages in the production of the balanced fertilizers which help American farmers to better crops and better incomes.

SUNSHINE STATE POTASH A PRODUCT OF NEW MEXICO U.S.A.

REG. U.S. PAT. OFF.

HIGRADE MURIATE OF POTASH 62/63% K_2O
GRANULAR MURIATE OF POTASH 60% K_2O MIN.

UNITED STATES POTASH COMPANY
INCORPORATED
30 Rockefeller Plaza, New York 20, N. Y.
Southern Sales Office
Rhodes-Haverty Building, Atlanta, Georgia

sistance from the hot peppers to the bell pepper by crossing them.

A. A. Foster, E. F. Cairns, and Bruce Hopper of USDA, reporting on their pine nursery research in the Southeast, said that a combination soil treatment of methyl bromide and a fungicide boosted the percent of marketable slash pine seedlings from 35 to 100. Apparently the chemical combination controlled a nematode-fungus complex.

In tests against the sting nematode on sandy soils, South Carolina Experiment Station pathologist Quintin Holdeman found EDB and Nemagon to be more effective than D-D mixture. All three soil fumigants reduced nematode damage and boosted yields of soybeans, corn, and sweet potatoes, but EDB and Nemagon gave the biggest returns in these tests.

In California, Experiment Station pathologist Bert Lear found that split soil treatments with one-half the normal amounts of D-D and Nemagon effectively controlled the stem and bulb nematode as a pest of garlic plants.

Discovery of a promising new group of nematode-destroying chemicals was reported by two University of Rhode Island plant pathologists, A. C. Tarjan and P. C. Cheo. They found that certain of the non-volatile chemicals known as "fatty acids" have outstanding nematocidal properties. In comparative tests with a recognized nematocide, chloropicrin, the scientists found water preparations of some of the fatty acids to be 8 to 10 times more deadly. Experiments with one of the acids—undecylenic acid—against tobacco nematode cysts (egg - containing structures) showed that immersion of the cysts for 30 minutes in a 2 percent acid-water preparation, prevents further hatching of the nematodes.

Reports on antibiotics, though not so extensive as those on nematodes, nevertheless included two notable achievements by USDA plant pathologists.

W. J. Zaumeyer, S. P. Doolittle, and R. E. Wester said that two more diseases important to vegetable growers—downy mildew of lima beans and late blight of tomatoes—have been controlled experimentally with antibotic sprays. Equally significant, better control of the downy mildew fungus was obtained with crude forms of streptomycin than with pure forms. The scientists also found that addition of copper to the antibiotic sprays gave effective disease control with very low dosages of antibiotics.

Another USDA plant pathologist, C. A. Thomas, said that using streptomycin, he had eradicated bacterial leaf spot disease from sesame seed. Naturally infected seeds of Palmetto, one of the new, non-shattering varieties of sesame, were soaked for 30 minutes in a water solution containing 250 parts per million of streptomycin, and then were planted in isolated plots in Maryland and Virginia. In comparison with other plots of untreated infected seeds, no evidence of leaf spot was found in any of the sesame grown from treated seed, but the blight was common in the untreated sesame.★★

NAC Offers Radio Talks

Four talks by outstanding experts on pesticide safety have been transcribed by the National Agricultural Chemicals Association for use by radio farm directors and program directors throughout the United States.

Speakers and their transcribed talks are: Maynard H. Coe, National Safety Council - "Farm Safety In The Chemical Era"; Dr. David E. Price, U. S. Department of Health Education and Welfare - "How Safe Are Today's Pesticides?"; Dr. A. L. Miller, U. S. Representative from Nebraska and author of the Miller Pesticide Residue Amendment - "The New Law And You"; and L. S. Hitchner, executive secretary, NAC Association - "It's On The Label."

This transcription is the first of a new series of radio platters being prepared by the Association in a program to improve public understanding of pesticides, and to provide information about the increasing number of new uses for pesticides, and their benefits to agriculture and the general public.

•

Purdue PCO Conf. Jan. 30

A discussion of stored grain and food product pests was to be featured at the annual Purdue Pest Control Operators Conference scheduled for January 30 to February 2 at the Agricultural Hall, Purdue University, Lafayette, Ind. Discussions dealing with these pests were to include laboratory identification, damage recognition, microanalysis, life history and habits, sources of infestation and preventive measures, clean grain program and chemical control.

Another feature of the three day meeting was to be a series of demonstrations on the application of dust insecticides, and a review of the problem of insect resistance. Also included in the program were reports and discussions on bird and rodent control, with a review of anticoagulants and demonstrations of bait preparation and placement.

•

Flexible Merges With Bemis

Flexible Package Co., Chicago, has merged with its parent company, Bemis Bro. Bag Co. A. D. Hoeppner continues as manager of the Bemis Bro. Bag Co. Flexible Package Plant, as this unit is now known.

This operation will be moved to Terre Haute, Indiana, as soon as a new building now under construction there is completed. Most of the Bemis polyethylene bag manufacturing eventually will be consolidated there.

•

Garman Discusses Farm Picture

Discussing the "Changing Farm Picture" at the fourth annual fertilizer conference of Colorado, W. H. Garman, National Plant Food Institute, reported that farmers in 1954 spent 51 percent more for fertilizer and lime than in 1947-49. The meeting was held January 9th at Colorado A&M College, Fort Collins, Colo.

After reviewing changes in farm production efficiency, size of farms, farm commodity purchases, etc., Dr. Garman advised also that with respect to crop yields, one can say that the nation-wide prospects for 1956 are rather favorable at this time.

As an adsorbent carrier...

approved by both laboratory tests and practical use—

DILUEX

ASSURES BETTER

Pesticide Formulations

As a carrier and diluent for insecticides, fungicides, sprays and dusts, Diluex and Diluex A exceed the most exacting qualifications of the agricultural chemical industry.

Diluex and Diluex A are basically an aluminum magnesium silicate mineral, having an amphibole-like structure possessing a large adsorption capacity for liquid impregnation procedures used in processing the newer complex organic insecticides. Both products are widely accepted as superior grinding or milling aids for technical grade toxicants such as DDT and BHC and will discharge readily from commercial dust applicators giving uniform coverage and maximum fractionation of toxicant and carrier in the swath.

Write for complete specifications and samples; our technicians are available to help with your processing operations.

For soil pesticide formulations, try adsorptive granular Florex.

FLORIDIN COMPANY

ADSORBENTS . . . DESICANTS . . . DILUENTS

Dept. M., P.O. Box 998, Tallahassee, Fla.

Equipment BULLETINS

New Carbide Booklet

The 1956 edition of the booklet, "Physical Properties of Synthetic Organic Chemicals," has just been issued by Carbide and Carbon Chemicals Co., a Division of Union Carbide and Carbon Corp., New York. This booklet is prepared annually as a helpful guide for chemists, engineers, purchasing agents, and laboratory workers.

This 24-page edition features 32 new products available from Carbide and Carbon. It presents the latest data on more than 350 organic chemicals. The products are arranged by related groups with condensed data on applications. Physical properties are given in tabular form. An alphabetical index is included for easy reference.

•

DuPont Garden Package

Du Pont offers a new squeeze duster package for garden dusts, known as "Whiff'n poof". The package is a cylinder of "Alathon" polyethylene resin, fitted with a directional nozzle. DuPont insecticide-fungicides to be available in the 1956 season in the new container are Rose Insecticide and Fungicide, Floral Dust, Vegetable Garden Dust, and Tomato Dust.

•

MGK on Pyrocide Dust

McLaughlin Gormley King Co., Minneapolis, Minn., offer several leaflets describing "Pyrocide Dust" for use on crops. One bulletin discusses the use of Pyrocide Dust for control of a variety of pests on certain crops.

Another bulletin, "Non Toxic and Low Residue Agricultural Insecticide Concentrates" presents information on pyrocide dust storage and handling, packing, labeling registration, application to crops and in greenhouses. This bulletin is of particular interest to formulators and manufacturers.

Low Cost Trailer Sprayer

Century Engineering Corp., Cedar Rapids, Iowa, offer a new low cost trailer mounted boom sprayer. The company advises that one advantage of this unit is that users save the work of attaching and detaching equipment from the tractor.

The unit fits all tractors, and will carry two 55-gallon oil drums.

Century offers also a heavy duty trailer which has a somewhat larger capacity.

•

New Blaw-Knox Buln.

Design, engineering, construction and initial operation of process industries plants by the chemical plants division of Blaw-Knox Co., Pittsburgh, Pa., are outlined in a new catalog, entitled "Process Plants by Blaw-Knox." Illustrated with photographs of major projects, the brochure is designed to provide information on the diversity and scope of work undertaken and completed in the process industries field.

A discussion of fertilizer and pesticide plants constructed by Blaw-Knox includes illustrations of the BHC plant for Commercial Solvents Corp., Terre Haute, Ind.; granular mixed fertilizer plant at Tuscola, Ill., for Illinois Farm Supply Co., and the disinfectant plant at Lincoln, Ill., built for Lehn & Fink Products.

New Automatic Cattle Rubber

Yuille Farm Chemical Co., Higginsville, Mo., announced recently a new automatic cattle rubber for controlling external parasites of cattle. The unit includes a one gallon storage tank with needle valve control. The insecticide is put into the applicator where the material filters out, as the unit is used.

•

Penn Ind'l Bulletin

Technical data on Picco solvents and solvent oils are included in a new 6-page bulletin published by Pennsylvania Industrial Chemical Corp. These products are derived either from coal tar or petroleum and cover a complete range from low to high boiling solvents and a series of non-drying solvent oils. Charts showing typical analysis and distillation ranges for various grades are included.

•

Bag Closing Machine Bulletin

Union Special Machine Co., Chicago, is currently distributing a descriptive bulletin, No. 200, on its equipment for closing filled textile and paper bags. The brochure gives complete information about Union Special sewing heads, columns, tables, conveyors, and accessories.

To facilitate selection of machines, the bulletin contains easy-to-use tables which detail the characteristics of both sewing heads and machines. In addition to full descriptions and photographs of equipment, the brochure contains many installation pictures which show the adaptability of the equipment to various plant conditions.

•

R & H Booklet on Surfactants

A nineteen page booklet now available describes the complete series of Triton nonionic surface-active agents manufactured by Rohm & Haas Co., Philadelphia.

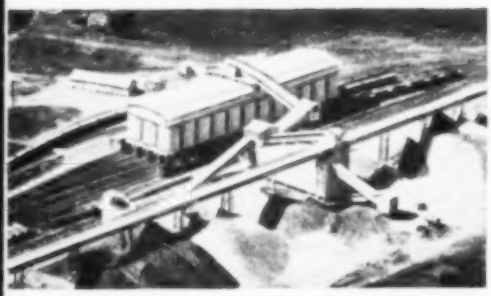
An informative list of suggested applications, and a chart matching requirements to products of the series, are in the final section of the booklet. Triton nonionic surface-active agents are recommended for uses in fields such as agricultural chemicals.

Three of the A.A.C. Co's electrically-operated draglines at work at our phosphate mines in Central Florida. Bucket capacities range from 9½ to 17 cubic yards. The 17-yard draglines with their 175-foot booms each weigh more than a million and a half pounds and can move 35,000 tons of material in 24 hours. From these rock deposits flow a continuous stream of high quality phosphate rock, assuring a dependable source of supply of AA QUALITY phosphorus products, see list below.

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY · AA QUALITY · FOUNDED 1872

AA Quality...

for over 85 years a symbol of quality and reliability



From the air—wet rock storage and drying plant, with dry rock storage silos in background. These silos, 29 in number, have a total capacity of 40,000 tons of dried rock. Under the silos are four runways where 40 railroad cars can be loaded at a time.

principal AA QUALITY products

All grades of Florida Pebble Phosphate Rock
AA QUALITY Ground Phosphate Rock
All grades of Complete Fertilizers **Superphosphate**
Gelatin **Bone Products** **Salt Cake** **Ammonium Carbonate**
Sulphuric Acid **Fluosilicates** **Insecticides and Fungicides**
Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY

GENERAL OFFICE: 50 CHURCH STREET, NEW YORK 7, N. Y.

30 FACTORIES AND SALES OFFICES, SERVING U.S., CANADA AND CUBA—ASSURE DEPENDABLE SERVICE

INDUSTRY MEETING CALENDAR

Jan. 30-Feb. 3—Pest Control Operators Conference. Purdue University. Lafayette, Ind.

Feb. 6-8 — Cotton States Branch of the ESA and Southern Agricultural Workers. Biltmore Hotel. Atlanta.

Feb. 7-9 — N. Y. Garden Supply Trade Show. Kingsbridge Armory. New York City.

Feb. 7-10—Seed and Fertilizer dealer meetings, throughout Tennessee. Feb. 7, Andrew Jackson Hotel, Nashville; Feb. 8, City Hall, Jackson; Feb. 9, Tenn. Wesleyan College, Athens; Feb. 10, King Arthur Court, Greenville.

Feb. 9-10—Wyoming Weed and Pest Control Conference. Fremont County Fair Grounds. Riverton, Wyoming.

Feb. 15-16—Crops, Soils Fertilizer Conference, Student Union, Oklahoma A & M College. Stillwater, Okla.

Feb. 15-17—California Weed Control Conf., Sacramento & Davis, California.

Feb. 16-17—Annual joint meeting of midwestern college agronomists and fertilizer industry representatives. Edgewater Beach Hotel, Chicago.

Feb. 20-21 Southwestern Branch, Entomological Society of America. Hotel Texas, Ft. Worth, Texas.

Feb. 22-24 Alabama Plant Pest Control Conference. Alabama Polytechnic Institute. Auburn, Alabama.

Feb. 22-24 Midwestern Chapter of the National Shade Tree Conference. La Salle Hotel. Chicago, Illinois.

Feb. 22-25—Ohio-Indiana Agricultural Aviation Conference, Ohio State University, Columbus, Ohio.

Feb. 28-29—5th annual Pesticide Chemicals School. Clemson College, Clemson, S. C.

Mar. 1-2—Potomac Division of the American Phytopathological Society Plant Industry Station, Beltsville, Md.

Mar. 5-16 — Nematode Training Course, U S Department of Agriculture, Plant Pest Control Branch, nematode laboratory, Hicksville, L. I., N. Y.

Mar. 6-8—Pest Control Operators' Conference. Frear Lab., Pennsylvania State Campus, University Park, Pa.

March 14-18 National Agricultural Chemicals Assn. Hollywood Beach Hotel, Hollywood, Fla.

March 28-30—North Central States Branch of ESA, Purdue Memorial Union, Lafayette, Ind.

April 11-12 7th Insect & Rodent Short Course for Sanitarians. Purdue University, Lafayette, Indiana.

June 10-13 National Plant Food Institute. The Greenbrier, White Sulphur Springs, West Virginia.

June 28-30—Association of Southern Feed & Fertilizer Control Officials, Hotel Roanoke, Roanoke, Va.

Handbook of

INSECTICIDE DUST DILUENTS AND CARRIERS

250 Pages

$4.75 in USA $5.25 Elsewhere

THE original publication "Properties and Commercial Sources of Insecticide Dust Diluents and Carriers" prepared by T. C. Watkins and L. B. Norton of Cornell University has been brought up to date and completely revised by Drs. Weidhaas and Brann. The new edition contains commercial information as well as data obtained in research conducted at Cornell University, Ithaca, New York.

The book is bound in a flexible leatheroid cover, for handy, practical use.

TABLE OF CONTENTS

Botanicals
Sulfur
Tripolite
Diatomite
Calcium Limes
Magnesium Limes
Calcites
Dolomites
Gypsum
Mica
Vermiculite
Talc
Pyrophyllite
Montmorillonoid Group
Kaolinite Group
Attapulgite Group
Unidentified Clays
Phosphates
Indeterminates
Synthetics

Postpaid if check sent with order

TEAR OFF AND MAIL

DORLAND BOOKS
P.O. Box 31
Caldwell, N. J.

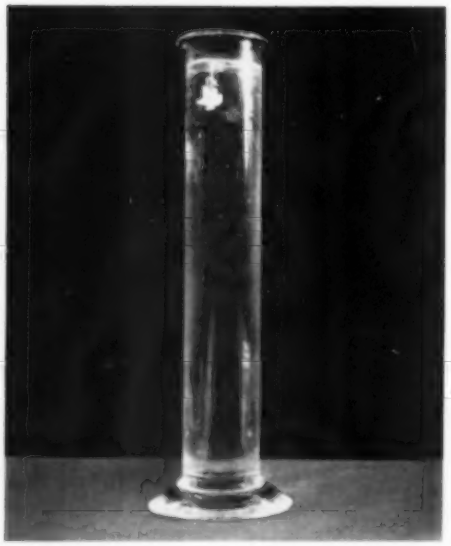
Enclosed is our check for $4.75 (Canada and Foreign, $5.25) covering a copy of the HANDBOOK OF INSECTICIDE DUST DILUENTS AND CARRIERS. It is understood that we may return the book within ten days for a full refund.

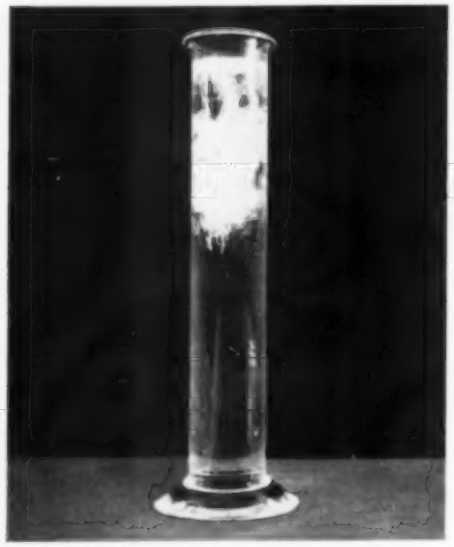
Name .....

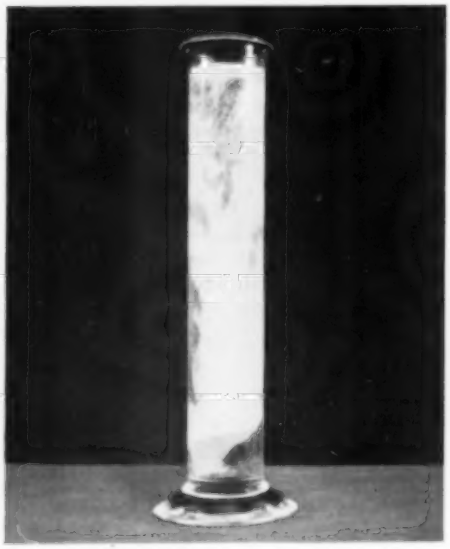
Company .....

Address .....

City and State .....







THIS TIME-DISPERSION TEST shows convincingly how TRITON X-151 and TRITON X-171 impart excellent spontaneity in water. In the first photo, a few milliliters of a Toxaphene concentrate containing these emulsifiers are added to a water-filled graduate. 30 seconds later emulsification is practically complete—*even without agitation.*

From drop to emulsion in 30 seconds with TRITON emulsifiers

When pesticides are formulated with TRITON X-151 and TRITON X-171, they disperse quickly in water even without agitation. This means that with one or both of these emulsifiers you can now improve the salability of practically any emulsifiable concentrate.

Unlike ordinary emulsifiers, TRITON X-151 and TRITON X-171 impart improved spontaneity *along with* excellent stability in the resulting emulsion. Because they're ether-type emulsifiers, they also enable the concentrates themselves to better resist breakdown during long storage.

An ever-important advantage of TRITON X-151 and TRITON X-171 is that they're the only two emulsifiers you need for a wide variety of toxicant-solvent systems and water hardness conditions. This simplifies processing and storage, and eliminates waste if solvents or pesticides are later changed. Write today for samples and complete data.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

TRITON *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

NEWS

Brevities

AGRICULTURAL EQUIPMENT AND CHEMICAL CO., Shreveport, La., have been granted a charter of incorporation, listing capital stock of 1,000 shares no par value.

AC

CHARLES E. MARTIN was appointed northern area sales manager of the Phosphate Minerals Division of International Minerals & Chemical Corp., Chicago.

AC

DIAMOND ALKALI CO., Cleveland, Ohio. Sales in 1955 totaled approximately $110,280,000, representing an increase of 18% above the 1954 figure of $93,505,000, the previous all-time peak. Net earnings in 1955 increased 53% to approximately $8,400,000, equivalent.

AC

H. C. DAVIS, manager of paper specialty plants, Bemis Bro. Bag Co., St. Louis, has been appointed a director of operations. He is succeeded as manager of paper specialty plants by A. L. Park, now assistant to Judson Bemis, director of central operations.

AC

GUANOS Y FERTILIZANTES, Mexico D.F., has under construction a fifth fertilizer plant, scheduled to be in operation early this year. The $8 million plant in Puerto Mexico, will produce 180,000 tons a year of ammonium sulfate and a series of nitrophosphates.

AC

DON R. MUNRO has been appointed sales manager for the Chase Bag Co., Milwaukee branch.

AC

NAPCO INDUSTRIES, Inc., Minneapolis, is at present manufacturing two models of industrial loaders, with a complete line of attachments.

POTASSE ET ENGRAISE CHIMIQUES, a French firm, has announced plans to build an ammonia plant at Grand Couronne, near Le Havre. It is scheduled for operation in 1957.

AC

DOANE COUNTRYWIDE FARM PANELS is the name for a new market research service offered to farm families by Doane Agricultural Service, Inc., St. Louis, Mo. The Doane panel expects to provide answers to such marketing questions as: what the farmer wants, needs and buys.

AC

ALFRED A. MULLIKEN, native of Newton, Mass., has joined the staff of the Chemical Specialties Manufacturers' Association as assistant secretary. Mr. Mulliken will directly assist H. W. Hamilton, who served for the last 15 years as secretary and managing director.

AC

CORN'S HIDDEN ENEMIES, the film story of one corn farmer's successful fight against soil insects, is being reissued free of charge to county agents and other farm leaders by Shell Chemical Corp., N. Y.

AC

THE AGRICULTURAL AMMONIA INSTITUTE will hold its 1956 convention in Atlanta, and its 1957 meeting in Little Rock.

AC

C. L. MONSON, Spencer Chemical Co.'s agricultural sales representative in Iowa for the past five years, has been named product sales supervisor.

AC

AMERICAN AGRICULTURAL CHEMICAL CO. has borrowed $12 million from institutional investors on a 15-year term for expenditures on a new fertilizer plant at Humboldt, Iowa, and for general corporate purposes.

QUEBEC AMMONIA CO. will go ahead with an $8 million ammonia plant at Varennes, Que. The company has arranged for sufficient financing through negotiation of at least one major long-term sales contract.

AC

PEST CONTROL OPERATORS will hold a conference March 6-8 in Frear Laboratory on Penn State Campus, University Park, Pa.

AC

DR. REED A. GRAY, plant physiologist of Merck & Co., Rahway, N. J., won first award of $1,000 in the 1955 Glycerine Research Awards for his discovery that glycerine increases the effectiveness of antibiotics against plants.

AC

MINERALS PROCESSING, INC., Denver, Colo., broke ground Jan. 10 at the firm's quarry, 25 miles east of Salida, Colo., where a soluble soil amendment will be mined. Minerals' agriculturists say the ore contains 11 minerals which improve the physical structure of soil and stimulate growth of beneficial soil micro-organisms.

AC

OLNEY PAINT CO., Spartanburg, S. C. was recently incorporated and authorized to manufacture, buy and deal in paints, insecticides, tar products and acids. R. B. Olney is president.

AC

WALSENBURG, COLO., is considering ordinances giving two firms 99-year leases on properties, with the understanding that two plants will be built for making chemicals and fertilizer. The two firms are Cotarco, Inc., organized as a Colorado firm and Ambaugh Chemical, Inc., of Memphis, Tenn.

AC

WESTERN POTASH CORP., Calgary, Canada, recently reorganized and is now called Continental Potash Corp. The change in name coincides with a change in capitalization in preparation for an $18.5 million expansion program.

AC

TOM A. EADON, JR., is the new sales manager of the Chase Bag Co., Philadelphia branch.

New MFA Concentrated* Fertilizer Plant Now On Stream...

***Based on diammonium phosphate**

Missouri Farmers Association, one of the nation's largest farm cooperatives, is now producing 200 tons per day of high analysis fertilizers at this new plant near Joplin, Mo. First to produce complete granular fertilizers for its members, MFA selected Dorr-Oliver as architects-engineers for this new project. And D-O engineers delivered by bringing the plant into full production just a little over three months after the first raw materials left the feeder bins!

Using the Dorrco Continuous Granular Fertilizer Process, the plant produces a variety of complete mixtures, all based on diammonium phosphate. Included are 14-14-14, 14-28-14 . . . and 12-36-12, the highest analysis complete fertilizer ever produced for general farm use.

If you are considering entering the fast-growing chemical fertilizer field — or if you plan to expand present facilities — it will pay to check with Dorr-Oliver.

Free flowing granules . . .

important characteristic of high analysis chemical fertilizers produced by Dorr-Oliver designed plants.

Write for Bulletin #8000, or better still, let us send an engineer to discuss your problem from the standpoint of economics and process. No obligation, of course.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

DOW CHEMICAL CO., Midland, Mich. recently completed plans with The National Junior Vegetable Growers Association for enlargement of the Dow farm youth activity.

AC

AMERICAN SMELTING AND REFINING CO., New York, recently appointed D. K. Wright as manager, by-products sales, succeeding L. G. Matthews, who retired December 31.

AC

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP., Cincinnati, O., opened its 13th warehouse last month.

AC

BEMIS BROS BAG CO. last month announced the retirement of R. C. Van Horn as manager of the company's Indianapolis plant and sales division. He will be succeeded as manager by D. A. Clarke, now assistant manager.

AC

WISCONSIN ALUMINUM RESEARCH FOUNDATION moved its Chicago Office to 20 North Wacker Drive, Chicago, early in January. New phone number is FInancial 6-3050.

AC

JOHN P. GRADY has been named assistant general sales manager of the Chase Bag Co., Chicago. He is succeeded as eastern regional sales director by Harrison B. Rue.

•

FMC Personnel Changes

The following new appointments have recently been announced by the Chemical Divisions of Food Machinery and Chemical Corp.

Joseph Green has joined the staff of the FMC central research laboratory. He was formerly with the U. S. Rubber Reclaiming Co., Buffalo, N. Y. Pending completion of the FMC Chemicals research center at Princeton, N. J., Mr. Green is currently assigned to the Becco Chemical Division of FMC at Buffalo, N. Y.

John Rivoire has joined the development department of Westvaco Mineral Products Division, FMC, as manager of market research. He was formerly associated with Pfizer and Co., Inc. and with the Midwest Research Institute.

R. M. Hoyer has been appointed district sales manager, Westvaco Chlor-Alkali Division, FMC, for the Southern and Ohio Valley territory, and will establish headquarters at Westvaco's South Charleston, West Virginia plant on or about Feb. 1.

W. M. Clark will continue as southern sales representative under Mr. Hoyer, with headquarters at the Charlotte, N. C. office of Westvaco Chlor-Alkali Division, FMC.

N. C. PESTICIDE SCHOOL

(*From Page 41*)

work at the college indicates three control methods show promise. Repeated treatments of 2,4-D are effective, but can severely stunt and sometimes cause loss of clover stand with little or no effect on grass. On dormant grasses such as Bermuda, maleic hydrazide is effective but can also cause severe stunting. Where garlic is a problem in small grains, a combination of high nitrogen fertility and 2, 4-D appears to work reasonably well.

O. E. Rud, agronomy specialist, reported that after three years of testing it appears that a farmer would be "sufficiently safe" to use either chloro IPC or "Karmex" DL on cotton as a pre-emergence treatment. Over-dosage of "Karmex" DL can lead to severe crop stand injury, and stunting of cotton seedlings occurs when high dosages of chloro IPC are used.

Research on both peanuts and soybeans carried on for several years did not lead the college to recommend any chemical for control, although a few chemicals gave some promise. Research will continue on several materials under test.

Dr. T. T. Hebert, small grains researchman, gave some encouraging results on controlling loose smut on barley for which there has been no chemical treatment available. Explaining that the hot water treatment had "never been popular with farmers" and also hurts germination, he said that the new method consists, briefly, of soaking the seed in water for a certain length of time, then confining in air tight containers. He emphasized that the chemical dust treatment should still be used after the seed has dried.

F. A. Todd, extension plant pathologist, reported on the latest research and extension demonstration results with some of the newer materials. He said that fungicides containing ferbam, zineb, and maneb have given excellent control of both anthracnose and blue mold in flue-cured tobacco areas. While antibiotics such as streptomycin show promise in controlling blue mold, they do not control anthracnose. The antibiotics, especially streptomycin sulphate formulations, show good wildfire control in burley beds, however.

J. C. Ferguson, extension agricultural engineer, emphasized that regardless of the materials used, the best results cannot be obtained unless the proper application equipment is selected, properly calibrated and adjusted, and cared for.

Dr. R. L. Rabb, tobacco insect researcher, reporting on transplant solution placement for wireworm control, said that since transplant solutions proved effective in hand setters, and not so effective in mechanical transplanters, the main problem appears to be placement of solution. Thus, aldrin, chlordane, lindane, and heptachlor have been tested and are recommended for hand setters but not for mechanical transplanters.

Dr. F. E. Guthrie, entomologist in tobacco insects research, said that broadcast treatments (in which the insecticide is applied to the surface of the soil and then worked into the top six inches) are being recommended in 1956 for the first time for controlling wireworms in newly-set tobacco. At present, the college is recommending only granular and dust formulations, however. It is felt that the wettable powders and the emulsion concentrates will be recommended in the future. Dieldrin, aldrin, heptachlor, and chlordane are the insecticides suggested.

Dr. R. T. Gast, entomologist, reporting on the phytotoxicity of insecticides, solvents, and emulsifiers, said that some plants were severely stunted when certain materials, mainly solvents or emulsifiers, were used. Dr. W. J. Mistric, entomologist, said

the college is not recommending seed treatments using systemic insecticides in cotton insect control. Although these insecticides gave good insect control early in the season, they apparently affected the fruiting and maturity of plants.

Dr. C. H. Brett, research man in vegetable insects, reporting on control of wireworms in sweet potatoes using the broadcast method, said that chlordane, aldrin, heptachlor, and dieldrin all gave good wireworm control in 1955 demonstration. He suggested that a mixture of malathion and methoxychlor might give better control of many insects than either of these materials alone. Proper adjustment of the sprayer seems to be the key to effective corn earworm control.

Dr. A. S. Crafts, professor of botany, University of California, cited numerous examples of the misuse of herbicides. As one example, he reported that in the summer of 1948, about 2,000 acres of barley in the Tulare Lake Basin were sprayed with 2, 4-D esters to kill prickly lettuce so the grain could be combined. Application was by airplane. The grain was cut with combines and later the stubble was burned. This took place in the center of a large cotton-growing area, — and some 17 sections of cotton were injured. Although not all misuse of herbicides can be avoided, he suggested that "If the people who use herbicides had a clearer picture of what they were trying to do, at least some could be avoided."

PEST SURVEY

(*From Page 57*)

The plains false wireworm, *Eleodes opaca*, in both larval and adult stages was responsible for widespread damage in Carson and Armstrong Counties in 1955. The adult is a general feeder, and the larvae feed on seeds and roots of young plants, especially small grain. Several fields of fall-planted wheat were completely destroyed in Carson County by the insect eating the seed before germination. Beneficial insects were numerous in all sections of the Texas Panhandle. Nabids and lady beetles were very active and in most fields outnumbered harmful insects by a larger margin than the 2 to 1 ratio observed earlier in the fall. In addition to the Texas report on the brown wheat mite, Oklahoma reports the pest from several counties. Counts in Lincoln County averaged 70 per linear foot.

Other Insect Activity

The citrus blackfly has again been taken in the Rio Grande Valley area of Texas. This collection of nine larvae from a single leaf of a grapefruit tree in a 30-acre orchard near Mercedes, Hidalgo County, Texas, was made November 18, 1955. As in the case of the previous finds, arrangements were made immediately with the Texas Department of Agriculture officials for spraying the infested orchard.

The spotted alfalfa aphid continues to be of vital concern to alfalfa producers in many of the Western States. During the latter part of December, 1955, and early January, 1956, reports of heavy populations or damage were received from several States including Oklahoma, California, Nevada, Utah, Texas and Arkansas. The insect has now been reported from Idaho, having been found in Oneida County during August, 1955.

Certain winter vegetable insects are on the increase in some sections. California reports heavy infestations of loopers on lettuce in the Palo Verde Valley and medium heavy infestations of the cabbage aphid on cole crops in Santa Barbara County. In the lower Rio Grande Valley of Texas a lettuce aphid was appearing in over 60 percent of untreated lettuce fields. An insect tentatively identified as the tomato pinworm infested 60 percent of the fruit in one tomato field of Hidalgo County, Texas.

WASHINGTON REPORT

(*From Page 58*)

and seized what the New York Times reported to be "38,000 heads of poisoned lettuce." Long distance phone calls and telegrams flashed from coast to coast. Many of them originating and terminating in Washington.

After the first wave of consternation had passed, it appeared to be a fairly simple case. The Food and Drug Administration's official release states simply that "use of endrin is not permitted on this crop." The lettuce was shipped from El Centro, California.

Agricultural Chemicals' Washington reporter made an independent investigation which not only bears out the facts reported by the Food and Drug Administration but underscores these points: First, growers involved had ample warning of the danger; second, the outer leaves of the crop were not stripped, which had it been done probably would have resulted in no harmful residue at the time the crop entered Inter-State Commerce; third, because it was the first seizure under the Miller Law, enthusiasm on the part of those talking to the press may well have been responsible for the somewhat sensational headlines which appeared.

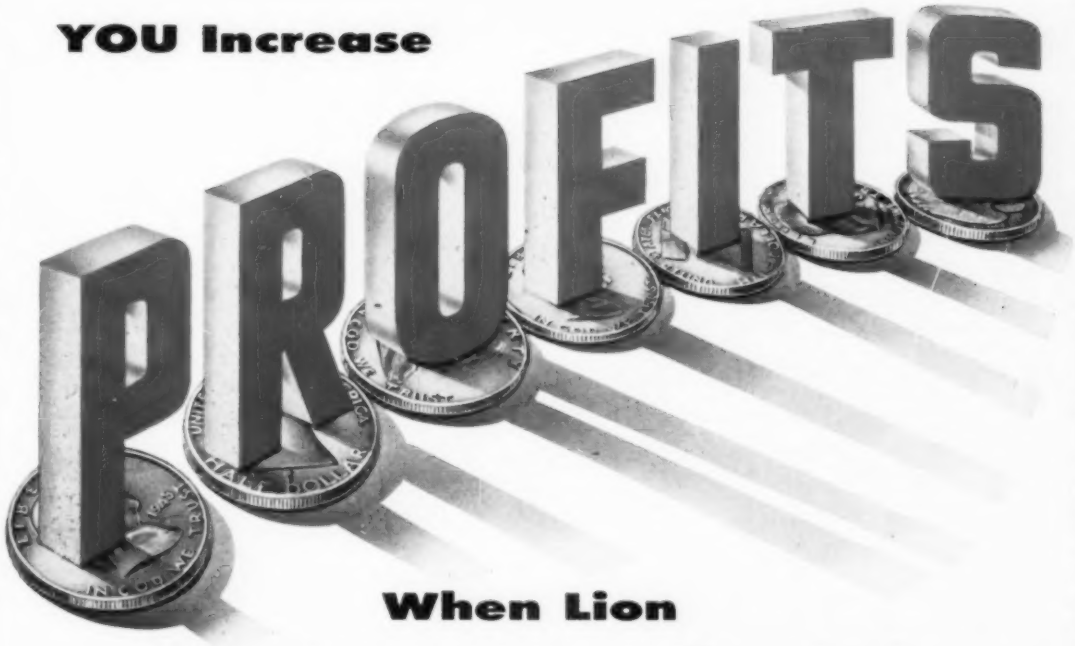
The Food and Drug Administration's policy, of course, is not to cause excitement among the consuming public in cases where there is no real danger. The Food and Drug Administration's opinion is that the condition of our food supply does not warrant concern or anxiety on the part of the consuming public. Therefore, headlines such as the one mentioned do not reflect the Administration's feeling.

The National Agricultural Chemicals Association's Washington office was in close and constant touch with the situation as it developed, and many members of industry were able to get rather comforting information from this source.

* * *

Nearly 100 pesticidal chemicals are among those for which status has been requested under the Miller Law. This means that a residue tolerance of zero or otherwise must be set by July 22, 1956. To date, according to Dr. Winton B. Rankin, Food and Drug Administration, 84% of the chemicals now have a status under the Miller Law on at least some of their uses. Some of the chemicals,

YOU Increase PROFITS



When Lion

- A Leader in Petro-Chemicals -

Supplies Your NITROGEN NEEDS

HERE'S THE LION LINE-UP OF QUALITY NITROGEN FERTILIZER MATERIALS

Lion Anhydrous Ammonia—82.2% nitrogen. Quality guaranteed.

Lion Aqua Ammonia—Ammonia content about 30%—other grades to suit your requirements.

Lion Ammonium Nitrate Fertilizer—Improved spherical pellets. Guaranteed 33.5% nitrogen.

Lion Nitrogen Fertilizer Solutions—Various types to suit your particular manufacturing needs.

Lion Sulphate of Ammonia—White, uniform, free flowing crystals. Guaranteed 21% nitrogen.

Now that the new fertilizer manufacturing season is in full swing, make sure you realize all the profits your plant can produce. *Where you buy* your raw materials can be vital and now, more than ever before, it pays to buy *your nitrogen needs* from Lion—a leader!

Lion nitrogen products are manufactured under rigid controls to meet exacting specifications—ending the costly production delays that result when ingredients vary in quality from day to day. With Lion products, you produce with maximum efficiency and profit—and you maintain the quality standards your customers demand.

Lion also provides an expert technical staff to assist you in solving difficult formulation and processing problems. And, throughout the year, Lion's sales building advertising tells farmers the plant food story—for your benefit. Lion's leadership in customer service stands out, offering you outstanding opportunities for increased profits—and your best season yet!

DISTRICT SALES OFFICES: NATIONAL BANK OF COMMERCE BUILDING, New Orleans, La. • SHEPHERD BUILDING, Montgomery, Ala.

LION OIL COMPANY

A DIVISON OF MONSANTO CHEMICAL COMPANY

EL DORADO, ARKANSAS

Knock out plant pests economically with

prentox pyronyl

Dust Concentrate

these are the facts:

1. Now, high concentrate of pyrethrum sold on *economical* basis!
2. Now, pyrethrum advantages incorporated with those of piperonyl butoxide!
3. Now, basic truck crop and home garden insecticide available at new low cost through addition of synergist to pyrethrum!
4. Fast killing action of pyrethrum – *free from toxological hazards!*

PRENTISS DRUG & CHEMICAL CO. INC. NEW YORK, N.Y.

PRENTISS pest-tested products you can count on:

DDT CONCENTRATES • CHLORDANE CONCENTRATES
WARFARIN • ROTENONE • SABADILLA • TOXAPHENE
LINDANE • PYRETHRUM PRODUCTS

Send today for technical literature on this NEW, fast-acting, economical PRENTOX PYRONYL DUST CONCENTRATE.

PRENTISS DRUG & CHEMICAL CO., INC.

110 WILLIAM STREET, NEW YORK 38, N. Y. · 9 SOUTH CLINTON STREET, CHICAGO 6, ILL.

however, still need a status on meat and some other general areas.

This leaves but 16% of the chemicals yet to be decided upon under provisions of the law. While the time and nature of the work involved for this 16% may be more than the percentage itself would indicate, it's apparent that the work under the Miller Amendment is going forth on a time table which means that residue tolerance matters should be pretty well resolved by July 22nd.

Tolerances have been issued at a rather rapid rate, with 69 handed down in a recent month. The delays involving the January 22 date, however, for such products as aldrin, dieldrin, toxaphene, etc., are temporary and do not change the overall time table.

* * *

At a meeting to launch the Golden Anniversary of the Food and Drugs Act of 1906, held in Washington, members of the food industry held the spotlight along with many Washington notables including members of Congress. The National Agricultural Chemicals Association is cooperating on the celebration, and will make a special note of achievements to date during its spring meeting when Food and Drug Commissioner George P. Larrick will appear on the program.

The Washington kick-off luncheon, launching a series of recognitions of the Golden Anniversary to be staged throughout the United States all during this year, was marked with pledges of harmony and progress for a wholesome food supply for the entire nation.

In his address, Commissioner Larrick referred to the need for a "balance wheel in our clock work of society, as science moves out of the laboratory and into commerce with its fantastic new developments." Referring to a recent study of the adequacy of enforcement of Food & Drug acts, the Commissioner referred to what he termed "the most comprehensive study ever made of the adequacy of Food & Drug Law enforcement in this country . . . showing that state Food & Drug laws need to be strengthened and better enforced in many states."

The Commissioner lauded the industries represented at the Luncheon for their dedication to the principles of public understanding, information, and recognition of the need for effective legislation to insure maintenance of high standards in the regulated products.★★

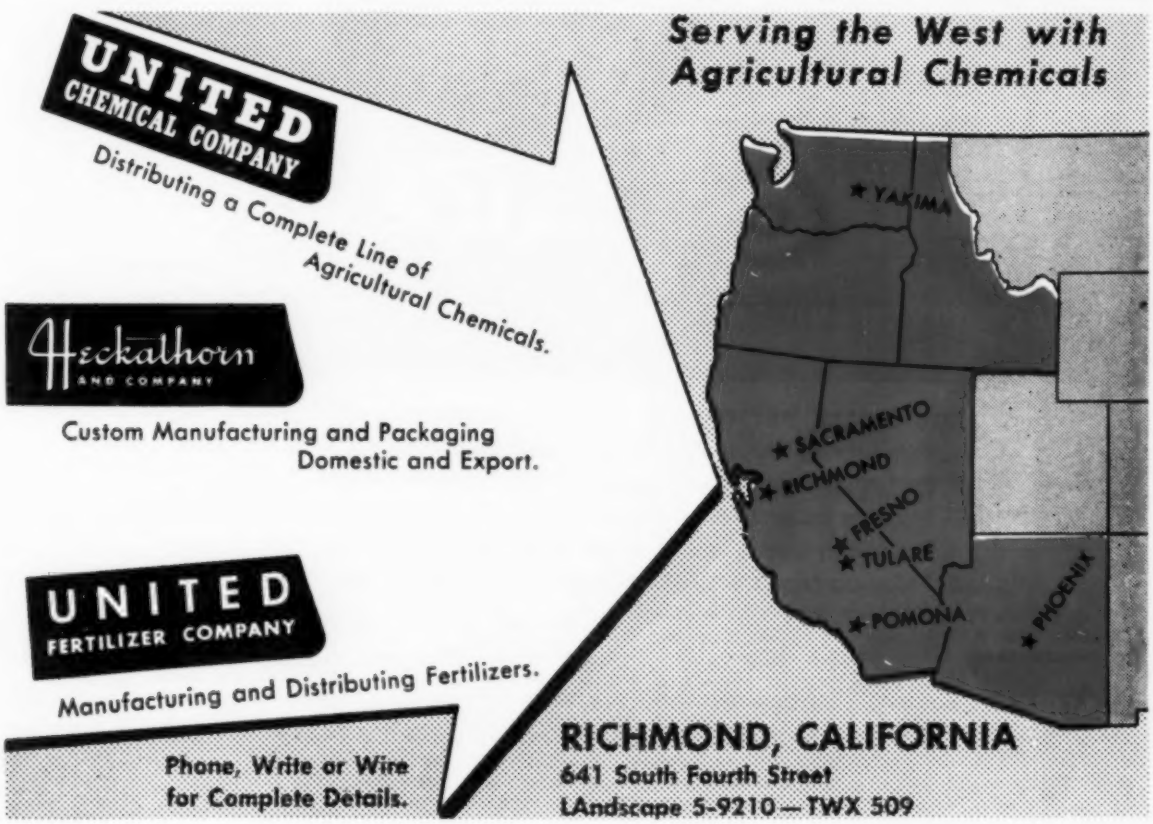
FUNGICIDE TESTS

(*From Page 56*)

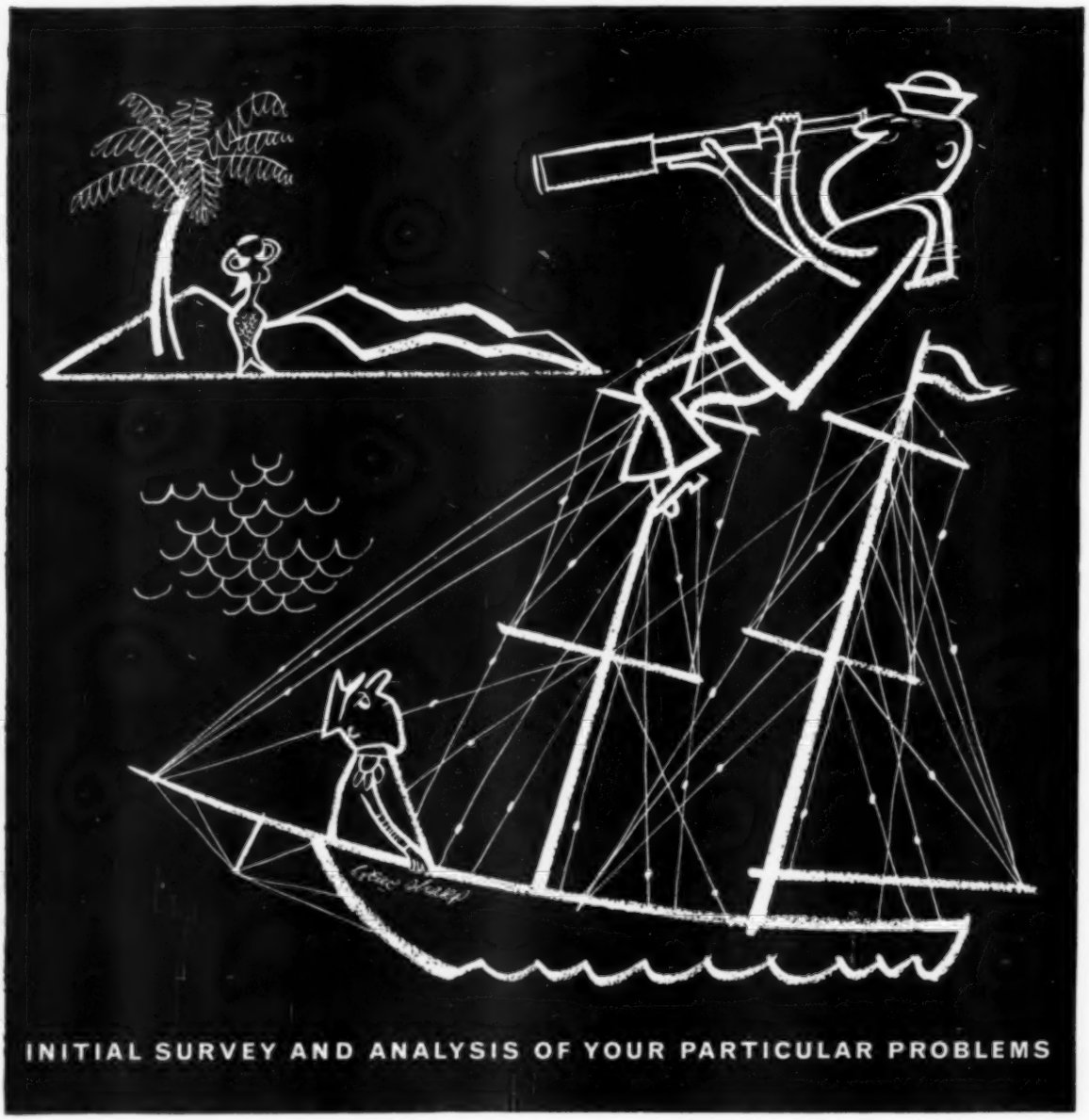
tions were made, spaced at 21-day intervals to deetrmine whether a 3-application program with 21-day intervals would prove as satisfactory as a 4-application schedule with 14-day intervals.

Under these experimental conditions, the performance of a fixed copper (Tennessee "26") was fair, but leafspot injury had reached almost 20 percent by August 25 (Table 3). Captan in the same schedule failed to provide adequate control of leafspot, and it became evident that the 21-day interval was too long for this fungicide.

In contrast to the 1951 experiments, superior control of leafspot was reflected only by increased height of the trees (Table 4). Low soil fertility undoubtedly limited growth in this experiment.



LOUISVILLE DRYERS are fitted to your job for faster, more efficient performance—lower cost in the long run!



LOUISVILLE METHOD

1. *Initial survey and analysis of your particular problems.*
2. Pre-testing in pilot-plant operation to assure performance.
3. Accurate design to meet your specific needs.
4. Top-quality fabrication in General American's own shops.
5. Follow-up checks after installation to guarantee mechanical perfection and efficiency.

PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

LOUISVILLE DRYING MACHINERY UNIT

GENERAL AMERICAN TRANSPORTATION CORPORATION

Dryer Sales Offices: 139 South Fourth Street • Louisville 2, Kentucky
380 Madison Avenue • New York 17, New York
General Offices: 135 South La Salle Street • Chicago 90, Illinois

1954 EXPERIMENTS: The experimental plots were shifted from the Dansville nursery area to Geneva. Both leafspot and powdery mildew were extremely damaging in the Dansville area, but, unfortunately, only mildew was severe in the Geneva plots.

When it became evident that leafspot would be light in the experimental plots at Geneva, data were taken in grower-sprayed blocks at Dansville. These data require considerable caution in interpretation, since some of the variation is unquestionably due to the effects of location. However, wide differences in leafspot and mildew control reflect the effects of timing or choice of fungicide. Grower schedules and materials are given in Tables 6 and 7, respectively.

In both schedules where Actidione was used (Nurseries B and C), outstanding control of leafspot was obtained (Table 6). The Fermate-fixed copper schedule used by Nursery A gave fair control, while captan in a 4-schedule application (Nursery E) was almost as satisfactory. If the June 15 application was omitted, leafspot control was reduced appreciably, even though effective fungicides such as Bordeaux 3-3-100 (Nursery D) and 8-8-100 (Nursery F) were used. Much of the defoliation in the latter block was due to copper injury.

The formulation containing Actidione plus micronized sulfur gave outstanding control of powdery mildew (Nursery C, Table 7). Actidione alone was comparable to Bordeaux 3-3-100 or fixed copper 3-3-100, but inferior to Bordeaux 8-8-100 in mildew control. Captan again gave little control of powdery mildew and the additional single Karathane application was applied too late to give any appreciable control (Nursery E, Table 7).

Data obtained in the experimental plots at Geneva duplicated those obtained at Dansville. In a 4-application schedule (14-day intervals) begun on June 12, the performance of actidione was again outstanding in regard to leafspot control (Table 8). Control of powdery mildew with actidione was about equal to that obtained with fixed copper (Table 9).

1955 EXPERIMENTS: The same experimental block at Geneva sprayed as budlings in 1954 was used in the 1955 experiments. The season was extremely unfavorable for leafspot, and development of powdery mildew was relatively slight. A 4-application schedule with 14-day intervals was used with the initial application made on June 16.

Although none of the materials received a severe test, their rank in leafspot and mildew control was essentially that found in 1954 (Table 10).

DISCUSSION: The data presented clearly demonstrate two principal factors in control of leafspot and powdery mildew of cherry nursery stock—choice of fungicide and proper timing of the initial application.

Of the materials tested, Actidione has given outstanding control of leafspot and is perfectly compatible with sulfur for increasing the degree of mildew control.

Table 6. Leafspot injury on commercially-sprayed Montmorency sour cherry, Dansville, 1954.

Fungicide	Rate	Nursery	Per cent leaves with lesions		Per cent defoliation		Total leafspot injury[a]	
			7/15[b]	9/1	7/15	9/1	7/15	9/1
Ferbam	2-100	A	9	17	2	9	11	26
Fixed copper	3-3-100							
Actidione	2 ppm	B	0	1	0	0	0	1
Actidione-Sulfur	2 ppm 5-100	C	0	tr	0	0	0	tr
Bordeaux	3-3-100	D	14	19	6	23	20	42
Captan	1½-100							
Karathane	2-100	E	7	20	3	12	10	32
Bordeaux	8-8-100	F	6	11	2	42	8	52
Ferbam	2-100	G	17	42	8	45	24	87

[a]Summation of leaves off plus leaves with lesions.
[b]Dates on which counts were made.

Table 7. Effect of fungicides on control of powdery mildew of Montmorency sour cherry, Dansville, 1954.

Fungicide	Nursery[a]	Per cent terminals with mildew		Per cent leaves per terminal mildewed	
		7/16[b]	9/5	7/16	9/5
Ferbam 2-100					
Fixed copper 3-3-100	A	84	100	19	37
Actidione 2 ppm	B	74	100	17	40
Actidione 2 ppm-Sulfur 5-100	C	17	5	9	7
Bordeaux 3-3-100	D	80	100	16	36
Captan 1½-100					
Karathane 2-100	E	81	100	33	59
Bordeaux 8-8-100	F	73	100	19	29
Ferbam 2-100	G	93	100	31	44

[a]Refer to table 5 for timing application.
[b]Dates on which counts were made.

Table 8 (See Pg. 56)

Table 9. Effect of fungicides on control of powdery mildew of Montmorency and Morello sour cherry, Geneva, 1954.

Fungicide	Per cent terminals with mildew				Per cent leaves per terminal mildewed			
	Montmorency		Morello		Montmorency		Morello	
	7/21	9/11	7/21	9/11	7/21	9/11	7/21	9/11
Actidione 2 ppm	71	100	76	100	20	38	27	36
Captan 1½-100	84	100	85	100	27	46	30	49
Bordeaux 1½-3-100	75	100	71	100	19	31	24	32
Control	97	100	93	100	32	44	32	47
LSD 19:1	11	NS	10	NS	9	7	8	8
LSD 19:1	NS	NS	NS	NS	NS	NS	NS	NS

Table 10. Effect of fungicides on control of leafspot and powdery mildew of Montmorency sour cherry, Geneva, 1955[a].

Fungicide	Percent leaves with lesions	Percent defoliation	Total leafspot injury	Percent terminals mildewed	Percent leaves per terminal mildewed
Actidione 2 ppm	2	tr[b]	2	88	42
Actidione 2 ppm-Sulfur 2-100	2	1	3	8	20
Bordeaux 1 1-3-100	5	3	8	83	45
Control	11	9	20	96	68

[a]Data taken August 9.
[b]Less than 0.5 percent.

FOR POISONOUS POWDERS THAT MUST NOT SIFT—

DUOTITE BAGS

with interlocking bottoms

To make sure your product won't sift—to give your customer full value—pack your insecticide in Continental's Duotite bags! Each bag has a double-folded and heat-sealed bottom, which, combined with liners, gives absolute assurance against product loss. The top of each bag can be heat-sealed after filling, too. Add to this sift-tightness the eye appeal of crisp color-printing by Shellmar-Betner craftsmen, and you have a package that will mean bigger sales for you.

This is only one of many packages that Continental now makes for chemical products. If you'd like better flexible packaging for your product, check with us today.

SIFT-PROOF
BOTTOM
Each bag is specially lined, double-folded, and heat-sealed. This means positive protection against sifting . . . full measure of quality for your customers.

CONTINENTAL CAN COMPANY

SHELLMAR-BETNER DIVISION

QUALITY PRINTERS AND CONVERTERS OF FLEXIBLE PACKAGING MATERIALS

Although the material has been tested for only two seasons, its performance both years at different locations was exceptional.

Copper fungicides, in general, have given good to excellent leafspot control, but control of powdery mildew with these fungicides was not usually satisfactory. None of the remaining fungicides performed satisfactorily in the application schedules chosen.

Leafspot and powdery mildew are occasional limiting factors in tree size in the nursery under western New York conditions.★★

MILLER LAW

(*From Page 37*)

and Rodenticide Act became law. It requires economic poisons, a term that includes fungicides, to be registered by the Department of Agriculture before they are shipped interstate. Before registering a fungicide, that Department determines that it is biologically effective, and that the label has proper directions for use and adequate warnings to protect the operator of the spray rig.

But the Department of Agriculture went farther. It asked the Food and Drug Administration to consider the toxicity and residue data submitted with a new chemical, and to state whether the proposed directions for use would be apt to leave hazardous residues on food crops.

We were glad to cooperate. For several years now the Department of Agriculture has given us a chance to comment on new pesticides before it registered them. Sometimes we have recommended that labels not be registered if there were evidence that proposed directions would leave potentially harmful residues, or if there were not enough data to permit a sound opinion. Thus the requirements of the food laws have been considered as labels were registered in recent years.

The formal tolerances we have been establishing are, for the most part, the same as the old informal tolerances we had when making recommendations to the Department of Agriculture.

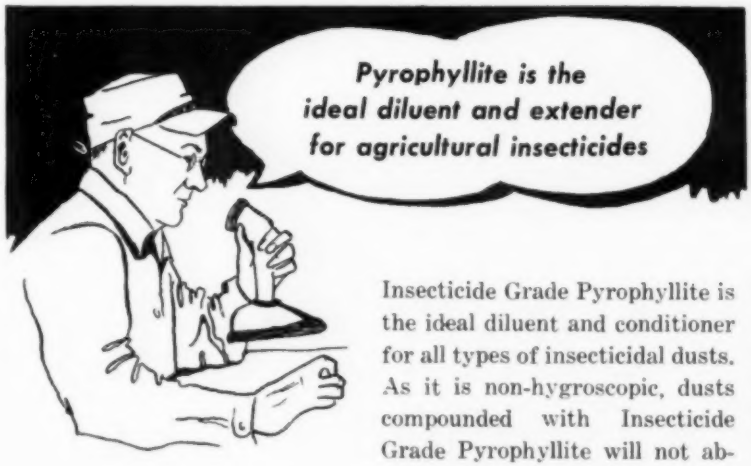
Now back to the question: During the coming growing season the plant pathologist can recommend fungicide uses that appear on labels currently registered with the Department of Agriculture. These uses should leave residues that are safe and meet the formal tolerances established under the Federal Food Drug and Cosmetic Act.

WHERE does the grower stand under the new law? Growers must understand that it is not safe for them to experiment with new pesticides on crops. They should use the materials according to label directions on the *crops* specified, in the *amounts* specified, and at the *times* specified.

But the need for ordinary prudence in the use of fungicides should not alarm the consuming public or the growers. When a tolerance is established by the Federal Government, it means that

(1) crops should bear no more than the tolerance level of residue.

(2) the fungicide can be employed usefully in agriculture; this has been established by the certificate of usefulness furnished the Food and



Glendon's Insecticide Grade Pyrophyllite

Wt per cubic foot—30 lbs

92 to 95% will pass a 325 mesh screen

pH range of 6 to 7

Non-alkaline and chemically inert

Average particle size below 5 microns

Insecticide Grade Pyrophyllite is the ideal diluent and conditioner for all types of insecticidal dusts. As it is non-hygroscopic, dusts compounded with Insecticide Grade Pyrophyllite will not absorb moisture. Nor is there any tendency even during extended storage, for the carrier to separate from the active ingredients.

Insecticide Grade Pyrophyllite has superior adhering properties, and because it is difficult to wet, it holds well on the plant leaves even during rain. When used as a carrier for products to be dusted by airplane, it settles rapidly, minimizing drift, waste of materials, etc.

Send for Testing Samples

GLENDON

Pyrophyllite Company

P. O. Box 2414

Greensboro, N. C.

Plant & Mines, Glendon, N. C.

Drug Administration by the Department of Agriculture.

(3) residues up to the tolerance level are safe; this has been established by adequate experimental studies on animals.

(4) when the pesticide is used properly it will leave residues that are within the permitted level; we will not issue a tolerance unless there is evidence that it can be met.

WE have been asked a number of questions recently about how the Food and Drug Administration enforces the Federal Food, Drug, and Cosmetic Act with regard to spray residues. Our procedures, broadly speaking, are as follows:

Before the growing season, we try to keep abreast of new developments with regard to pesticides and new recommendations in spray schedules issued by the States. During the growing season, Inspectors in growing areas keep in touch with State authorities and growers to determine what sprays and dusts are being used and how. The Inspectors may pick up a few samples from farms or from shipping points for examination. These examinations permit us to confirm earlier observations made during the growing season about the likelihood of high spray residues.

Then during the shipping season, some samples will be collected at shipping points and at destination for further examination for spray residues. When we go into a growing area to make investigations, we will go openly, we will cooperate with the State and local agricultural authorities, we will make every effort to be helpful in connection with our inspectional activities.

Unfortunately, our laboratory facilities are extremely limited. We cannot offer to run samples for spray residues for all who would like to have such tests made on their crops; however, if the samples that we collect to confirm our inspectional observations show high residues before a crop has been placed in interstate commerce, we will get in touch with the appropriate State authorities immediately so steps may be taken to reduce residues prior to shipment.★★

Pike's Peak

ABSORBENT CLAY

A SUPER CARRIER
AN OUTSTANDING DILUENT

NOT only will you save on ton prices, but Pike's Peak Clay will help speed up production. Its high degree of absorbency improves grinding and impregnating all toxicants. Pike's Peak's uniformly low moisture and pH of approximately 5 assure you of complete compatibility with a *wide range* of toxicants.

The extremely fine particle sizes provides outstanding flow characteristics before and after impregnation. The standard grind is guaranteed 95% through 325 mesh with a variety of other particle sizes available to meet your specifications.

A trial in your plant will convince you. Write today for complete technical data.

General Reduction Company

1820 Roscoe Street — Chicago 13, Illinois

ROLE OF ENTOMOLOGY

(*From Page* 47)

explored if farmers are to do the most effective job of producing livestock feed.

Biological control is another research field that should be exploited more fully wherever possible. If entomologists can find and establish natural enemies of some of our important insect pests—like the corn borer parasite Lydella, for example—farmers will have a tremendously effective and economic means of reducing or controlling those pests.

Insect control, of course, always will require the use of insecticidal chemicals — the entomologist's first line of defense. But we have to recognize that the chemicals now in use may not be effective indefinitely, because of the ability of insects to develop resistance to them. This calls for constant searching for alternate

(*Turn to Page* 105)

NOW, DIRECT FROM US, PESTMASTER*DDT Technical for your dusts, wettable powders, solutions, and emulsions. This leading brand of 100% DDT is hard, clean, stable. Its use will add kill, stability and uniformity to your formulations. Phone, write or fill in the coupon below for prices, conditions and samples.

Users or exporters of 75% DDT Wettable powder should investigate our PESTMASTER* Brand. Review its resistance to tropical conditions, its uniform wettable and suspension properties, its carefully controlled packaging which preserves its qualities. Remember, PESTMASTER* 75% DDT Wettable does the job when it gets on the job — Asia, Africa, South America, Europe, here at home—wherever you want it. Write for prices, conditions, samples. Use the coupon.

Send a sample of PESTMASTER* DDT Technical Grade (100%) ☐ Prices ☐
Send a sample of PESTMASTER* 75% Wettable ☐ Prices ☐

Name.....

Company or Government Agency.....

City.....State.....Country.....

MC** ®

MICHIGAN CHEMICAL CORPORATION
501 N. Bankson Street, Saint Louis, Michigan

EASTERN SALES OFFICE
230 Park Avenue
New York 17, New York

*REG. U.S. PAT. OFF. **T.M.

D-55-1

QUALITY PRODUCER OF PESTMASTER* DDT & METHYL BROMIDE AND OTHER AGRICULTURAL CHEMICALS

"The hands unload them rough"

—says Fred Schroer, Jr. of Valdosta, Ga.

"I've never seen a thread give under this pounding and believe me, if they weren't tough burlap bags, we'd have a heavy loss over the years from waste."

Fred should know. He and his brother, Herbert, now run the 1200-acre farm of their father, Fred W. Schroer, retired Master Farmer and pioneer in the modern agricultural age of South Georgia. Mr. Schroer says he's been using burlap bags since 1912 and, "During the years, I've had less trouble with burlap bags than any one thing I use. First thing I did this year was put in our fertilizer order—in burlap bags, of course. You can't beat them—no matter how you try or what you use."

That's a strong statement from such an outstanding farmer, but typical of what farmers all over the country tell us. Burlap bags are *preferred* by farmers.

Just ask your own customers—

they'll tell you that burlap

Is strong — takes dragging, dropping, *man-handling* — any tough job on the farm.

Gives good ventilation — keeps farm supplies and products fresh.

Laughs at sudden showers — wetness or dampness can't weaken it.

Saves money — extra value from re-sale and re-use.

Saves storage space — stacks to any height without slipping.

Has 1000 uses — always in demand on the farm (popular with farm wives, too!)

THE BURLAP COUNCIL

of the Indian Jute Mills Association

155 East 44th Street, New York 17, N. Y.

chemicals to be made available before the numbers of resistant insects can build up to epidemic proportions.

Of parallel importance will be studies on the insects themselves to determine the resistance mechanism, what happens to the insecticide in the insect's body, and how the development of resistance can be prevented or combatted. To overcome this problem of resistance, the full cooperation of chemists, physiologists, geneticists, and other scientists in allied fields is essential.

Similarly, plant scientists need the help of entomolgists in determining the effects of insecticides—particularly systemics—on the physiological make-up of the plant and the effects on yields of crops grown in soils containing insecticide residues. Livestock scientists will need the same kind of help in determining effects of insecticide on animals and their products—particularly those intended for human consumption.

As the use of chemicals for insect control expands, the residue problem becomes more important. The greater public concern over the extensive use of agricultural chemicals of all kinds—insecticides, fungicides, herbicides, and growth regulators—has led to new laws like Public Law 518. In the future more of our research efforts will have to be devoted to residues, and work on insecticide residues will have to be coordinated with that on other chemicals—particularly those that are used on the same crops or soils.

We all agree that insecticides recommended must be employed in a way that will result in a minimum amount of residue on the treated crop at harvest or when grazed. This amount must not exceed tolerances established by the Department of Health, Education, and Welfare in accordance with the requirements of Public Law 518. Methods must be developed that will detect minute quantities of the residue. It is necessary also that the continued use of pesticides will not damage plants or livestock, accumulate excessively in soils, or affect the flavor or quality of the crop.

In 1955, Congress appropriated funds for additional research on spray residues. As a result, additional staff members have been added at the laboratories at Vincennes, Ind., and Yakima, Wash. A new laboratory has been established at Tifton, Ga., in cooperation with the State Experiment Station, to give special attention to pesticide residues on cereal and forage crop plants. Work there will be concentrated on effects on flavor and quality, and on improvement of analytical techniques. Expanded studies, too, are under way at Kerrville, Texas, on residues in meat and milk, and at Beltsville on methods of analysis. Work at Morrestown, N. J., dealing largely with soil problems, is being maintained at its present level. The Department is also cooperating with the state experiment stations on regional projects on pesticide residues in the four regions.

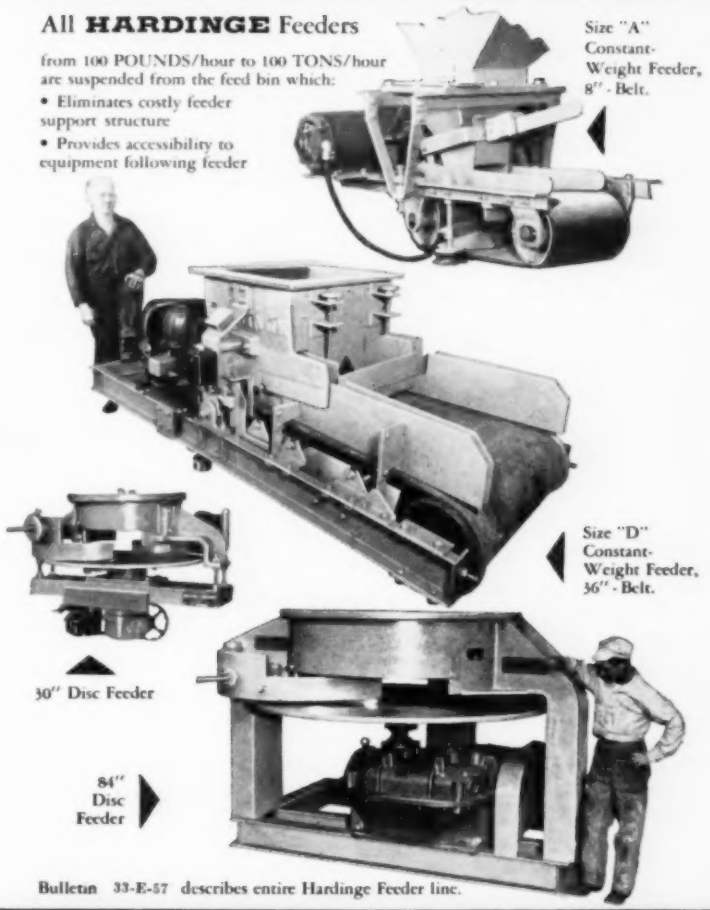
State experiment stations and industry are also devoting a great

LOW INSTALLED COST

All HARDINGE Feeders

from 100 POUNDS/hour to 100 TONS/hour are suspended from the feed bin which:

- Eliminates costly feeder support structure
- Provides accessibility to equipment following feeder



Bulletin 33-E-57 describes entire Hardinge Feeder line.

HARDINGE COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

For Dependable Insecticides and Herbicides

think first of DIAMOND

Technicals and Formulations

Insecticides

DIAMOND dependable insecticides have long been favored because of their uniform high quality. DDT, BHC and Lindane Technicals are supplied in many types and forms.

Insecticides for Formulators and Producers

DDT—100% Technical
DDT—Wettable Powders
DDT—Dust Concentrates and Emulsions
Lindane—Emulsions, Wettable Powders, Dusts
Lindane—100% Gamma Isomer of BHC
BHC—40% Technical
BHC—12% Wettable Powders and Dusts
BHC—Emulsion Concentrates
K-101—Miticide

Weed Killers and Brush Control Chemicals

DIAMOND weed and brush killers, based on the 2,4-D and 2,4-T chemical groups, meet every weed and brush control problem.

These dependable DIAMOND herbicides are produced in two forms: *Technical* for use by formulators and processors in their own formulations and *ready-to-use formulations* for farmers, ranchers, country clubs and homeowners.

Technicals for Formulators

WEED KILLERS

2,4-D Acid • Technical Butyl-D
Technical Isopropyl-D
Technical 2-Ethyl Hexyl (Iso-Octyl)-D (Low Volatile)
Technical BEP-D (Low Volatile)

BRUSH CONTROL

Technical Butyl-T • Technical Isopropyl-T
Technical BEP-T (Low Volatile)
Technical 2-Ethyl Hexyl (Iso-Octyl)-T (Low Volatile)

Ready-To-Use Formulations

WEED KILLERS

*4# Mixed Amine-D • 4# Dimethylamine-D
2.67# Butyl-D • 4# Butyl-D • 6# Butyl-D
4# 2-Ethyl Hexyl (Iso-Octyl)-D (Low Volatile)
4# BEP-D (Low Volatile) • 3.34# Isopropyl-D

BRUSH CONTROL

*4# Butyl-T • 4# BEP-T (Low Volatile)
4# 2-Ethyl Hexyl (Iso-Octyl)-T (Low Volatile)
2,4-D—2,4,5-T Mixtures • 2#—2# Butyl Brush Killer
2#—2# 2-Ethyl Hexyl Brush Killer (Low Volatile)
2#—2# BEP Brush Killer (Low Volatile)

*Numbers are pounds of 2,4,5-T or 2,4-D acid equivalent per gallon.

DIAMOND research is constantly seeking new and better insecticides and herbicides and working with formulators and agricultural chemists in the development of more efficient forms and application methods. We will be glad to work with you. For information on DIAMOND Chemicals and technical co-operation write, DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals

deal of effort to meeting this problem. Cooperation all around is quite evident. Several Government-industry conferences have been held on the development of analytical methods for determining insecticidal residues.

Another problem that undoubtedly will loom larger as we advance in chemical control of insects is the effect of insecticides on beneficial insects. We all recognize that if we are to use chemicals most effectively, we must find ways of protecting the natural insect enemies and the pollinators. When insecticides are allowed to destory parasites and predators of destructive insects, the result in some instances is that pests normally of minor importance on a crop may become serious pests following such treatments. In California several years ago when DDT was used widely for insect control in citrus orchards, the DDT didn't bother the relatively unimportant cottony cushion scale insects but it did destroy large numbers of the Vedalia insects, which fed on the scales. As a result, the cottony cushion scale became terrifically abundant in treated citrus orchards, and the use of DDT for this purpose has been practically discontinued.

The above reviews only a few of the problems in only one phase of agriculture with which entomologists are confronted. The many crops other than forage and pasture in which insect control is equally important have not even been mentioned. The tremendous job of keeping foreign insects out of our country—a job which is increasing rapidly as worldwide transportation is speeded up is still another direction of expansion of our industry. The problems become more numerous and the job of entomologists becomes bigger as demands on our agriculture increase in the years ahead.★★

BAYER 17147

(*From Page 33*)

use and supplied to growers at reasonable cost, it should provide another highly useful cotton insecticide, especially if difficulties are encountered in controlling the boll weevil as occurred in certain areas during the 1955 season.★★

References

(1) Conference Report on Cotton Insect Research and Control, Dallas, Texas, November 30 - December 1, 1954 (Eighth Annual Report). Supplement to 1953 Report, issued by U.S.D.A., Agr. Res. Serv., Entomology Research Branch.

(2) Ivy, E. E., J. R. Brazzel, A. L. Scales, and D. F. Martin, 1955. Two New Phosphate Insecticides for Cotton Insect Control. Jour. Econ. Ent. 48(3): 293-5.

(3) Robertson, R. L., and F. S. Arant, 1955. Effect of Bayer 17147 on Boll Weevil. Jour. Econ. Ent. 48(5):604-5.

NATURAL PREDATORS

(*From Page 44*)

is no simple pattern that distinguishes pesticides which are selective in their action upon pests and their natural enemies. By far the greatest selectivity appears to be derived from purely physical or habitudinal differences that exist between pests and their

THE BEST DILUENT COSTS NO MORE

Superior results *plus* competitive price put Barden Clay ahead of ordinary diluent-carriers. That's why leading insecticide producers standardize on Barden. Approximately 90% of Barden Clay particles are less than 2 microns — providing efficient dispersion, more surface area, increased potency of toxicant dust. Barden blankets both top and bottom of the leaf. In wettable powders, its high colloidal value offers superior suspension properties. Non-alkaline, it is compatible with organic toxicants.

Why be satisfied with less than the best, when the best costs no more? Barden Clay, the scientifically-prepared diluent, adds *extra power* to your product... *extra punch* to your sales. Samples on request.

J. M. HUBER CORPORATION
100 Park Avenue, New York 17, N. Y.

HUBER World's Largest Producer of Aerfloted Kaolin Clay

7-Point Barden Score	
✓	Improved dispersion
✓	Lower abrasion
✓	Better coverage
✓	Better retention
✓	Higher mortality
✓	Greater uniformity
✓	Maximum economy

For Dust or Spray...
use Barden Clay—
the Low-Cost Scientific Diluent

DIPTEREX*

Sugar Bait Fly Killer

DIPTEREX attracts and kills both resistant and non-resistant strains of houseflies with outstanding effectiveness. It is approved for use inside and around dairy barns, poultry houses, stables, stock pens and similar areas where fly populations are intense or bothersome.

The active ingredient of DIPTEREX Sugar Bait Fly Killer is Bayer L 13/59, a recent chemical development of Farbenfabriken Bayer.

DIPTEREX will be available to distributors for the 1956 season in ten pound metal pails packed four to a case and in one pound canisters packed twelve to a case.

* Registered Trademark

CHEMAGRO CORPORATION

101 PARK AVENUE, NEW YORK 17, N. Y.

natural enemies. The selectivity of systemics and of stomach poisons, for example, exploits the differences in feeding habits between the phytophagous pests and their carnivorous enemies. Dormant ovicidal treatments are in a way selective, owing to the low natural enemy activity at the time of application. Nonpersistent contact insecticides take advantage of the protected habitats of internal parasites as well as of the dispersal characteristics of parasites, which permit rapid re-entry into treated areas. A number of insecticides at field dosages exert a degree of favorable selectivity to predators, since the latter are often larger, or more vigorous, than their hosts, and consequently have greater insecticidal tolerance. Some predators, such as the larvae of green lacewins, and certain lady beetles or adult *Orius* spp., have a general ruggedness which makes them particularly tolerant to a number of our contact nerve poisons. On the other hand, adult parasites being ordinarily more delicate than their hosts are usually devastated by dosages required for pest suppression. Sometimes the selectivity of certain of the insecticides rests upon the fact that the material is not very toxic, except to small or thin-cuticled pest species, and consequently spares all but a similar type of natural enemy.

Insofar as chemical or physiological selectivity of pesticides is concerned, it seems safe to say that the present trend of search for high contact toxicity insecticides is not likely to lead to the discovery of many selective insecticides of general usefulness in the preservation of natural enemies. The probability that a powerful insecticide with fairly general contact toxicity would restrain pest species and not harm any of the diverse beneficial forms is remote. Furthermore, if the toxicity of a new material is not fairly general, its development is unlikely from an industry standpoint. High research and development costs, limited uses, and the ever-present prospect of insecticide resistance by the pests do not favor industry making such materials available.

There are a number of interesting cases of true physiological selectivity with respect to certain insecticides and agricultural pests, but such selectivity rarely follows any discernible pattern. Similarly, in laboratory tests performed in the Department of Biological Control at this station, there has been no pattern by which one can relate the tolerance of any natural enemy species to any insecticide. Without going into detail, one can say that in the tests so far performed, exceptional susceptibility is fairly common, but tolerance to field dosages of most toxicants has been rare, and more often exhibited by predators than by parasites. Where tolerance to an insecticide has been demonstrated, it generally offers only limited possibilities for practical use, since on any one crop it is rarely of great importance to be able to preserve a single species of natural enemy, while eliminating most of the other beneficial species.

It is true that a slight tolerance to a pesticide often exists with certain natural enemies and their hosts, from the standpoint of a minimum lethal dosage; but from the standpoint of the common overdosage of field usage, the differential tolerance very often becomes insignificant. In the majority of cases, a selective toxicity differential would have to be quite pronounced to be useful. It appears from past performance that this would most likely occur with pesticides which are of relatively low general toxicity, and with those which show some selectivity to pest species. If industry considers the development of these types of products warranted, such products may find increasing use in promoting lasting pest control. Until such new products become available, we must make the most advantageous use of the few now obtainable. With increased use of either old or new selective pesticides, pest control recommendations are likely to become more, rather than less, complex, and closer pest control supervision in the field seems inevitable.★★

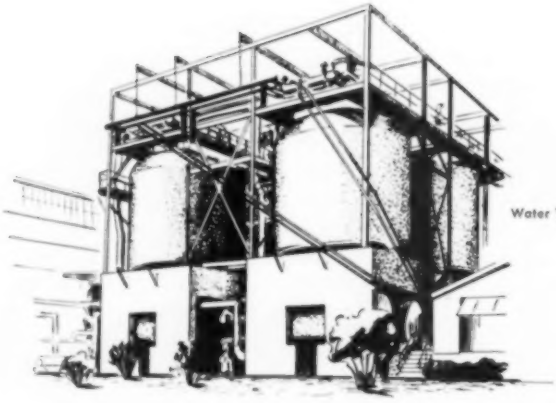
CHEMICALS
FOR AGRICULTURE

COPPER SULPHATE
Crystals Powdered
Basic Copper Sulphate

ZEE-N-O
Neutral Zinc 56% Zinc as metallic
The Highest Test Nutritional Zinc

MANGANO
Neutral Manganese 55% Manganese as metallic

W. R. E. ANDREWS SALES, INC.
1505 Race Street, Philadelphia 2, Pa.
Since 1926
Agricultural Chemical Specialists



Water Treating Plant

Crude Sulphur

for Industrial Use

from the properties of

Texas Gulf Sulphur Co.

75 East 45th Street • New York 17, N. Y.

Producing Units

- **NEWGULF, TEXAS**
- **MOSS BLUFF, TEXAS**
- **SPINDLETOP, TEXAS**
- **WORLAND, WYOMING**

SPENCER ARK-MO

(*From Page 31*)

uct size. This causes too many jagged-shaped particles in the finished product. Furthermore, the particles being made from larger particles are not sufficiently dry to ensure proper mechanical condition. The +6-mesh material should be removed at the end of the dryer, crushed, and returned to the head of the dryer. This change eliminates the need for a double-deck screen, but it requires two single-deck screens instead. Two per cent of diatomaceous earth is added to 14-14-14 and other high nitrogen grades as a parting agent to enhance mechanical condition.

The operational data sheet on 3-9-27 shows 4.5 tons per hour of recycle for a 10 ten per hour production rate. The only reason for this recycle is to remove the —20 mesh material from the finished product. Since the liquids in the formula are low, this recycle hinders granulation by competing with the other materials for the liquids present. In addition to the liquids shown in the formula, it is necessary to add 100 pounds of water as such per ton and 74 pounds of steam to bring about granulation. In this case, it would be better to recycle the hot fines, instead of cold fines.

A system of chutes in connection with the two single-deck screens will allow hot or cold recycle to be used, to suit the grade being made.

TABLE 1.
Ark-Mo Fertilizer Granulation Plant

Grade 14-14-14

FORMULATION	% Plant Food	#/Ton
Spensol C	37	762
Anhydrous Ammonium Sulfate		
Sulfuric Acid 66°Bé		194
Superphosphate	20	210
Triple Super	47	516
Potash	60	468
Filler		
Total		2160

FLOWS		
Production Rate	8	T/hr.
Recycle Rate	27	T/hr.
Total Throughput	35	T/hr.
Gas Consumed	2,100	CFH
Air Flow Dryer	14,000	CFM
Air Flow Cooler	15,000	CFM

TEMPERATURES	°F
Atmospheric	62
Burner Air	65
Ammoniator	180
Dryer Throat	420
Dryer Stack	195
Dryer Discharge	190
Cooler Stack	145
Cooler Discharge	
Finished Product	120

HUMIDITIES	#H_2O/#Dry Air	Dry Bulb	Relative %
Atmospheric	0.0094	62°F	79
Dryer Stack	0.052	175°F	18
Cooler Stack	0.026	140°F	29

SIEVE ANALYSIS (%)

	Ammoniator Exit	Cooler Exit	Finished Product	Recycle
Held on 6	38.6	28.4	4.7	0
Held on 14	58.8	52.7	92.4	9.0
Held on 20	78.3	75.5		51.1
Held on 40				87.2
Held on 65				

CHEMICAL ANALYSIS

	Ammoniator Feed	Ammoniator Exit	Finished Product
Moisture	1.80	3.00	2.40
N	11.14	13.46	13.71
Available P_2O_5	15.82	14.12	14.50
Insoluble P_2O_5	0.18	0.17	0.18
Total P_2O_5	15.00	14.30	14.68
K_2O	16.99	15.25	14.04

BERKSHIRE CHEMICALS BCI
ISCO

SPECIALISTS
in
MAGNESIA
for
AGRICULTURE

EMJEO (80/82% Magnesium Sulphate) Calcined Brucite (fertilizer grade) 65% MgO

POTNIT

(95% Nitrate of Potash)
for
Special Mixtures and Soluble Fertilizers
Other Fertilizer Materials

Insecticides - Fungicides

Mercury Compounds
for Agricultural Use

DITHIOCARBAMATES

FERRIC — ZINC

EXPORT-IMPORT

BERKSHIRE CHEMICALS INC
GRAYBAR BUILDING
420 LEXINGTON AVENUE • NEW YORK 17
LExington 2-5959 • "BERKSKEM" New York
55 New Montgomery St. • San Francisco 5, Cal.
Philadelphia • Boston • Cleveland • Chicago

Horse & Lion POWER . . .

All crops need nitrogen. When they do . . .

SELL HORSE & LION NITROGEN FERTILIZERS

Produced by a century-old chemical pioneer and leader, "Horse & Lion" nitrogen fertilizers are successfully used around the world. "Horse & Lion" nitrogen power for crop growth is *proven*. "Horse & Lion" nitrogens will prove successful for you and your trade. *Be sure with "Horse & Lion" power.* There are five "Horse & Lion" nitrogen fertilizers for various requirements:

"Horse & Lion" Calcium Nitrate: 15½% pure nitrogen, combined with about 28% available lime. Granulated.

"Horse & Lion" Calcium Ammonium Nitrate: 20½% pure nitrogen (10¼% nitric and 10¼% ammonic nitrogen) and approximately 33% calcium carbonate. Granulated.

"Horse & Lion" Ammonium Sulphate Nitrate: 26% pure nitrogen (11% nitric and 15% ammonic nitrogen). Granulated.

"Horse & Lion Urea 44": 44% pure nitrogen. Coated pellets for dry use.

"Horse & Lion Urea 46": 46% pure nitrogen. Pellets without coating for liquid application or dry use where fast dissolving is desired.

For complete information and prices, contact your nearest "HORSE & LION" *fertilizer headquarters.*

ATKINS, KROLL & Co.

ESTABLISHED 1906

DISTRIBUTORS, U. S. A.

500 Fifth Avenue, New York 36, N. Y.
417 Montgomery Street, San Francisco 4, California
417 South Hill Street, Los Angeles 13, California
421 S. W. Sixth Avenue, Portland 4, Oregon

Coarse potash was used in this formula. The sieve analyses are shown in Table 3. As can be seen in the picture of a bisected pellet, Figure V, the potash particle is the nucleus. Figure VI contrasts granules made with fine potash, where the potash particles are sticking loosely to the surface.

Table 4 shows analyses of various sieve fractions. The 3-12-12, 3-9-18, and 3-9-27 were made with coarse potash, and the 10-10-10 and 14-14-14 with fine potash. Attempts to granulate high potash grades with fine potash have been unsatisfactory.

Summary

THE Ark-Mo Plant has successfully granulated 16-20-0, 13-39-0, 10-20-0, 14-14-14, 13-13-13, 12-12-12, 10-10-10, 8-8-8, 10-20-10, 8-24-8, 6-8-12, 4-12-4, 5-10-5, 3-12-12, 3-9-18, 3-9-27 and 5-20-20. All the nitrogen was derived from Spensol, or a combination of Spensol and anhydrous ammonia. In addition to using low-cost nitrogen, these high analysis materials allow more room for normal superphosphate, which often further reduces formulation costs.

We recommend the elimination of one raw material screen and one raw material crusher. Also, the cooler should be the same size as the dryer.

TABLE 2.

OPERATIONAL DATA

Ark-Mo Fertilizer Granulation Plant

Grade 3-9-27

FORMULATION	% Plant Food	#/Tons
Spensol C	37	109
Anhydrous Ammonium Sulfate Sulfuric Acid	82.2	25
Superphosphate	20	900
Triple Super		
Potash	0	900
Filler		110
Total		2044

FLOWS		
Production Rate	10	T/hr.
Recycle Rate	4.5	T/hr.
Total Throughput	14.5	T/hr.
Gas Consumed	3,500	CFH
Air Flow Dryer	10,650	CFM
Air Flow Cooler	4,095	CFM

TEMPERATURES	°F
Atmospheric	79
Burner Air	86
Ammoniator	205
Dryer Throat	410
Dryer Stack	197
Dryer Discharge	200
Cooler Stack	150
Cooler Discharge	121
Finished Product	120

HUMIDITIES	#H_2O/#Dry Air	Dry Bulb	Relative %
Atmospheric	0.019	79°F	89
Dryer Stack	0.094	190°F	21
Cooler Stack	0.024	130°F	25

SIEVE ANALYSIS (%)

	Ammoniator Exit	Cooler Exit	Finished Product	Recycle
Held on 6	9.1	14.8	1.5	0.0
Held on 14	61.0	60.0	65.0	0.0
Held on 20	22.4	19.6	33.0	21.0
Held on 40	7.1	5.6	0.5	65.0
Held on 65	0.4	0.0	0.0	14.0

CHEMICAL ANALYSIS

	Ammoniator Feed	Ammoniator Exit	Finished Product
Moisture	4.60	4.68	1.48
N	1.39	4.81	* 4.74
Available P_2O_5	9.55	8.89	8.97
Insoluble P_2O_5	0.08	0.06	0.08
Total P_2O_5	9.63	8.95	9.05
K_2O	27.05	23.28	26.84

* Spensol requirement below flowmeter calibration. Corrected by installing smaller flowmeter.

Danitra

Scientifically Controlled

CUSTOM BLENDING of LIQUID and WATER SOLUBLE FERTILIZERS

to Your Specifications

Many manufacturers of concentrated liquid and water soluble fertilizers have experienced important economies by entrusting the formulating and blending of their products to the men and machines of our modern plant at Metuchen, N.J. With a dependable supply of materials at hand and technical know how at our command, we produce a number of quality controlled products for such firms . . . under their own brand labels.

If you should like to explore the profit possibilities of such an association we invite you to make an appointment to discuss your requirements and see how well we are equipped and staffed to serve you. A telephone call or letter to our New York office will bring you full information.

For instantly soluble trace elements in water soluble fertilizers, there is nothing finer than

NUTRA-MIN

our own blend of properly proportioned minerals: MANGANESE, IRON, ZINC, COPPER, BORON, MAGNESIUM, MOLYBDENUM.

Full information on the use of NUTRAMIN will be sent on request.

Davies Nitrate Co.

INCORPORATED

118 LIBERTY STREET NEW YORK 6, N. Y.

TABLE 3.

SIEVE ANALYSIS — RAW MATERIALS

	Fraction	Acc.		Fraction	Acc.
60% Potash (Coarse)			*60% Potash (Fine)*		
/6	0.0	0.0	/6	0.0	0.0
6/14	31.5	31.5	6/14	0.5	0.5
14/20	51.1	82.6	14/20	18.1	18.6
20/40	13.5	96.1	20/40	64.3	82.9
40/65	2.7	98.8	40/65	14.3	97.2
65/	1.2		65/	2.8	

TABLE 4

ANALYSIS SIEVE FRACTIONS

Grade	Particle Size	Total N	Total P_2O_5	K_2O	Free H_2O	Grade	Particle Size	Total N	Total P_2O_5	K_2O	Free H_2O
3-12-12	Blank	3.0	11.2	12.5	1.0		10/16	2.4	7.7	29.3	0.6
	6/8	2.9	11.9	11.0	0.9		16/	2.7	7.9	29.0	0.6
	8/14	2.9	11.0	13.2	0.8	10-10-10	Blank	10.0	10.9	10.8	0.8
	14/	3.1	11.2	13.7	0.9		6/10	10.0	11.5	9.4	0.8
3-9-18	Blank	2.9	8.9	17.9	0.6		10/16	10.1	10.9	12.6	0.8
	6/10	2.7	9.2	15.5	0.6		16/	10.4	10.8	11.8	0.7
	10/16	2.9	8.7	19.1	0.6	14-14-14	Blank	13.3	13.7	13.8	2.6
	16/	3.2	9.0	18.2	0.6		6/10	13.2	13.9	14.0	2.6
3-9-27	Blank	2.7	8.1	27.6	0.7		10/16	13.1	14.6	13.4	2.4
	6/10	2.9	9.4	21.7	0.8		16/	12.2	13.7	15.4	2.2

Handbook of Agricultural Pest Control

By S. F. Bailey
L. M. Smith

192 Pages
$3.25 in U.S.A.; $3.75 elsewhere

CONTENTS

The Commercial Agricultural Chemicals
Physical and Chemical Properties
Compatibility
Containers
Fumigants and Fumigation
Toxicology and Residues
Spray Oils and their Properties
Spraying Machines
Rates of Delivery of Spray Machines
Rates of Application for Sprays
Dusts and Dusting
Aircraft
Mosquito Control
Hazards
Miscellaneous Topics
Tables and Formulas
Terms and Symbols

Send Check with Order

TEAR OFF AND MAIL

INDUSTRY PUBLICATIONS, INC.
P.O. Box 31
Caldwell, N. J.

Enclosed is our check for $3.25 (Foreign and Canada $3.75) covering a copy of HANDBOOK of AGRICULTURAL PEST CONTROL. It is understood that we may return the book within ten days for a full refund.

Company .....

Address .....

BY .....

The process should be changed to remove the +6-mesh material at the end of the dryer, which will replace the double-deck screen with two single-deck screens for finished product. A system of chutes should be provided to permit the use of either hot or cool recycle. Spencer Chemical Co. Technical service is available to assist in these problems.★★

FERTILIZER VIEWS

(*From Page 53*)

rector of the Grasslands Division of the Department of Scientific and Industrial Research (N.Z.) warned that superphosphate is being used too freely and in an unbalanced fertility program. "There is very good evidence", he cautioned "that the wholesale use of phosphate is not increasing productivity in the slightest degree". He referred to the situation in New Zealand where the fertilizing of dairy lands up until recently has meant only one thing to 99 per cent of the local dairy farmers, namely the application of superphosphate.

A similar change of attitude toward superphosphate fertilization has been developing recently among

dairymen and agronomists of our own Northeastern Region. Here also up until a year or so ago, pasture fertilization meant phosphate fertilizer. The trend is definitely in the direction of using a mixture of phosphate and potash in the dressings. A 1-1-1 ratio mixed fertilizer, such as 10-10-10, is favored if the sward is predominantly grass, or a 1-2-2 ratio (5-10-10 grade) if the plant population comprises a good percentage of legumes.

I believe this changing practice is all to the good. Any lop-sided fertilizing program is inefficient. We have seen what happened to crop yields in the Plains States and in other sections of the Middle West following the constant use of nitrogen dressings exclusively: the soil reserves of minerals were rapidly pumped out by the nitrogen stimulation, and within five years a decline in yields set in.

A soil test carried out by a competent analyst, and interpreted by one skilled in the art on the basis of local correlated field tests, can be a valuable guide to the formulation of a satisfactory fertilizer program.

Many Americans may not be sufficiently familiar with New Zealand's agriculture to appreciate the warning sounded by Dr. Melville. The economy of that island country is based on the production of dairy, meat, wool and other essential products for world markets. In such an animal agriculture, superphosphate has until recently generally paid handsome dividends. That is why it has been used so generously and so universally.

Despite Dr. Melville's warning, however, it is the opinion of many farmers in the Waikato district for example, the country's best managed and largest dairying district, that the area is not using an excessive amount of superphosphate. Some of the best local agricultural scientists, as a matter of fact, favor more, rather than less, superphosphate. However, we know from our American experience and agronomic research that it is more profitable, as well as better farming practice, to apply dressings of complete fertilizers to pastures and meadows.

NEWS FROM NAUGATUCK

TOMATO YIELD UP OVER 300%

with

PHYGON®-XL

One Phygon-user* reports a tomato yield increase of from 107 to 384 bushels per acre over a 3-year period. That's just a sample of what you can expect when you include this remarkably inexpensive fungicide in a spray schedule. Result: many more market dollars with higher yields of higher grade tomatoes.

Phygon-XL gives outstanding control of late blight and gray mold (botrytis). It is simple to apply, mixes effectively with the most commonly used fungicides and insecticides and does not affect odor or flavor of fruit.

*Florida

Order Phygon-XL from your local supplier today. Write, wire or phone us if unable to locate immediate source of supply

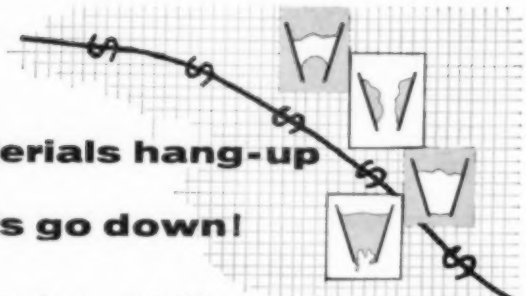
SEE – Naugatuck Chemical Division, United States Rubber Company, at work on NBC's "Color Spread" TV spectacular, Sunday, March 25, 7:30 PM, EST.

United States Rubber

Naugatuck Chemical Division

Naugatuck, Connecticut

producers of seed protectants, fungicides, miticides, insecticides, growth retardants, herbicides: Spergon, Phygon, Aramite, Synklor, MH, Alanap, Duraset.



When materials hang-up

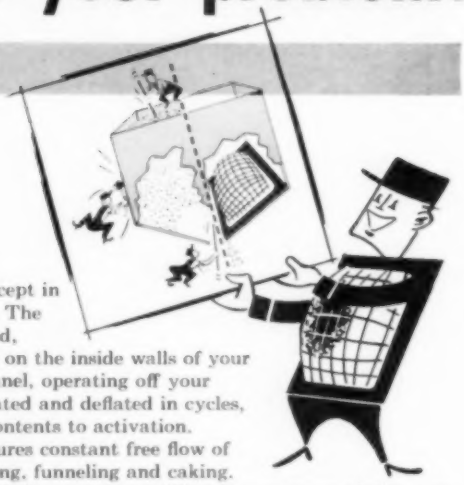
Profits go down!

How much is down-time, due to material hang-up in bins, costing you?

If you have a problem of material flow from your bins, your entire production line is bound to suffer.

PneuBin

can solve your problem!



- **Safe**
- **Economical**
- **Quiet**

PneuBin panels are a new concept in bin-stored material activation. The PneuBin panel is a steel-backed, Neoprene diaphragm mounted on the inside walls of your present bins. This PneuBin panel, operating off your regular plant air supply is inflated and deflated in cycles, positively displacing the bin contents to activation. This positive displacement assures constant free flow of materials . . . eliminates bridging, funneling and caking.

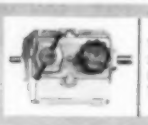
PneuBin engineers will gladly make no-obligation recommendations on your specific material handling problems. Write for FREE literature and "*Flow Stoppage Report.*"

GEROTOR MAY CORPORATION

MANUFACTURERS OF—

1545 MARYLAND AVENUE, BALTIMORE 3, MARYLAND

Hydraulic Pumps and Motors



Variable Speed Hydraulic Transmissions

PneuBin—Pneumatic Bin Evacuators

Customer Lectures Management

A new wrinkle in annual sales meetings was reported recently by *Chemical Week*. A New York firm invited to its sales-meeting three purchasing agents from industries it serves to get first hand views and suggestions as to how to serve them better. A whole afternoon was given to this exchange of views. The result proved very valuable and was followed promptly by changes in its sales activities. Among the important gains cited by the firm were these: (1) A better insight into key factors of the customer's buying decision; for example, service for one buyer was as important as price. (2) Annoying habits of salesmen generally were revealed, such as getting too familiar too fast with the buyer, not asking for the business, and not following regulations. (3) Buying procedures, such as who should be contacted, how often the salesman should call and when company executives should accompany the field men.

Wouldn't this same idea work with fertilizer firms? If several of the firm's farmer customers could be induced to attend an annual salesmeeting and talk freely regarding their experiences with salesmen and suggest what changes they would prefer in the improvement of customer-salesman relationship, much good might be derived from the practice. Of course the talks would have to be straight-from-the-shoulder type, and management and salesmen should be open-minded and willing to take criticism in the right spirit. ★★

LIQUID FERTILIZERS

(*From Page 51*)

the reactor tank. Therefore, in an endeavor to keep ammonia losses to a minimum, reactants are added at such a rate so as not to exceed a solution temperature in the reactor tank of 150°F. In respect to this method of operation a constant rate of flow for the reactants is not feasible for maximum production rates. It was found that the reactants could be added at a high rate in the early part of the batch cycle, but required a gradual reduction of flow by par-

tially closing the valves controlling the flow of the reactants to hold a maximum solution temperature of 150°F.

Operating in this manner, the average reaction time for a 14 ton batch of 8-24-0 is 1 hour and 30 minutes. An additional 45 minutes is required to transfer the solution from the reactor tank to storage and refill the measuring tanks. It has been the practice to run three 14 ton batches per 8 hour day. With one operator this provides adequate time for simultaneous aqua ammonia operation, tank car unloading, loading out the finished product, and clean up operations at the close of the working day.

Special Features

THE reactor tank is equipped with a pH meter and alarm. The electrodes of the pH meter are placed in such a position that the pH of solution is obtained at the discharge of the reactor. Laboratory data indicated that the pH of a true 1 to 3 nitrogen to P_2O_5 ratio, i.e., 7-21-0 or 8-24-0 was 6.8. It was found that by controlling the rate of flow of the phosphoric acid with the aqua ammonia, it was possible to maintain a constant pH of 6.8. By operating in this manner with a metered volume of aqua ammonia and water, it is possible to manufacture formulations with a very high degree of accuracy. Laboratory analysis by standard AOAC procedures of formulations using this pH method of control gave results of 8.0-24.0-0. This method of control was also used in the manufacture of 15-15-0 solution with a high degree of accuracy by first making a 7-21-0 formulation from aqua ammonia and phosphoric acid with a pH of 6.8 and then adding an additional metered volume of water and supplementary nitrogen required to give a 15-15-0 solution.

An additional and very important advantage of the pH method of control is that at all times the solution discharging from the reactor is neutral and non-corrosive, thereby eliminating the necessity for an expensive stainless steel reactor tank.

Adequate mixing of the solution in the reactor tank proved to be a necessity. The reactor tank was equipped with a mixer and two stainless steel impellers. One impeller was located near the reactor discharge near the bottom of the reactor tank, and the other impeller on the same shaft at approximately one-half the depth of the reactor tank. During the addition of aqua ammonia and phosphoric acid, the mixer was stopped. Rocks of ammonium phosphate as large as footballs formed almost immediately due to the high concentration of the ammonium phosphate solution at the reactor discharge. However, with adequate mixing, the formation of salt crystals presented no problem.★★

GRANULATION WITH UAL

(*From Page 46*)

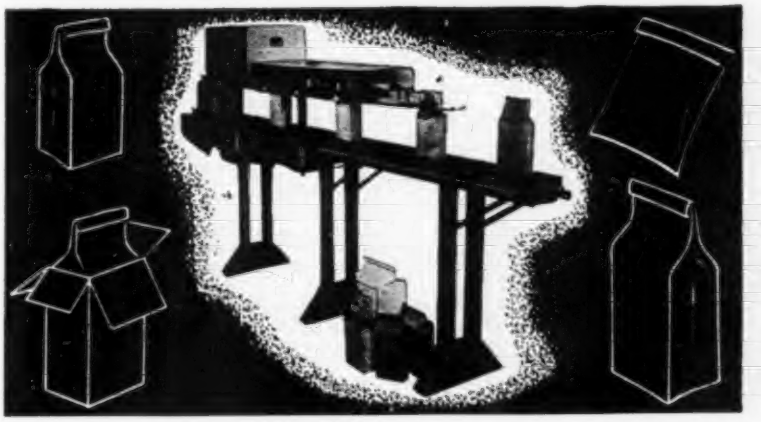
(Yield is taken as the sum of the fractions -4 to +20, plus ⅔ of this +4 fraction.)

Temperatures in the granulator-mixer were 180°-190°, and cooler exit material 124° F. Air temperature was 32° to 45° F. The cooler was not as effective as desired, since the heat transfer from granules is slower than from the conventional fine fertilizer, and because the low moisture content of the dried granules does not afford appreciable latent heat cooling. Increasing the air flow from the present rate of 5000 c.f.p.m. to 7500 or 10,000 would probably suffice. The efficient cooling of granular goods may well deserve some further attention to design on the part of equipment manufacturers.

TABLE 5

		Screen Fractions, in Per Cents									
		+4	−4 +6	−6 +8	−8 +10	−10 +14	−14 +20	−20 +35	−35	Total	% Yield
6-24-12	UAL-B	2	13	21	24	7	10	19	4	100	76

FRY BAG CLOSING MACHINE



Makes Sift-Proof Seals in Heavy Weight Paper Bags

Fry Model CSG automatically makes a double folded sift-proof heat seal in the top of any heavy weight paper bag. The first fold is securely heat sealed; the second is glued for extra safety.

Bags handled include polyethylene and pliofilm lined, polyethylene coated and those with thermoplastic top sealing bands. Simple adjustments for bags of various heights. This model also handles bags which are not heatsealable by gluing the folds.

Machine above is perfect for granular or fine products such as insecticides, chemicals, powdered paints, fertilizers, dog foods, etc.

Other models available . . . when writing, please submit a sample of your bag and your product.

GEORGE H. FRY COMPANY 42 East 2nd St. Mineola, L. I., N. Y. GArden City 7-6230

ORTHO *lindane*

GIVES YOU ALL THESE ADVANTAGES:

- ✓ High efficiency factor
- ✓ Excellent control of wide variety of insects
- ✓ Ease of formulation
- ✓ 100% gamma isomer
- ✓ Combines effectiveness with economy

On all chemicals, read directions and cautions before use.

CALIFORNIA SPRAY-CHEMICAL Corp.
Executive Office: Richmond, California
Portland, Ore. • Whittier, Calif.
San Jose, Calif. • Fresno, Calif.
Sacramento, Calif. • Caldwell, Idaho
Maryland Heights, Mo. • Troy, Ala.
Orlando, Fla. • Phoenix, Ariz.
Shreveport, La. • Maumee, Ohio
Linden, N. J. • Medina, N. Y.
Goldsboro, N. C.

T.M.'S REG. U. S. PAT. OFF.: ORTHO

World leader in agricultural and garden chemicals

ORTHO
SCIENTIFIC PEST CONTROL

TABLE 6

12-12-12		Lbs./Ton N	P_2O_5	K_2O	NH_3	H_2O
340	UAL-A 45.5	154.7			125	85
70	Urea 45	31.5				
316	Ammon. Sulfate 21.0	63				
412	R P super 19.5		81		(	
					(—52	70
372	Conc. super 45		167		(	
400	Muriate 61			244		
270	60° H_2SO_4				—73	62
2180		249.2	248	244	0	217
—180						—180
2000						37

TABLE 7

5-20-10		Lbs./Ton N	P_2O_5	K_2O	NH_3	H_2O
230	UAL-A 45.5	105			84	57
960	R P super 19.5		187		(	
					(—78	124
500	Conc. super 45		225		(	
333	Muriate 61			204		
27	CaO-MgO					
100	60° H_2SO_4				—27	23
2150		105	412	204	—21	204
—150						—150
2000						54

TABLE 8 Properties of "Uramon" Ammonia Liquors

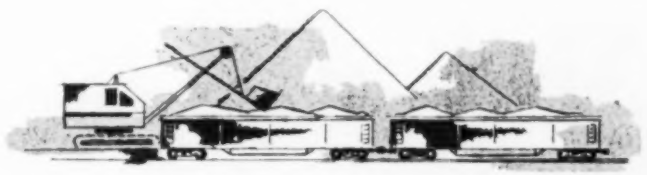
Total N	UAL-A 45.5	UAL-B 45.5	UAL-C 37.0
Composition			
Urea	32.5	43.3	26.5
Ammonium Carbamate	10.5	15.0	8.6
Ammonia	32.2	24.1	26.3
Water	24.8	17.6	38.6
	100.0	100.0	100.0

Total N	UAL-A 45.5	UAL-B 45.5	UAL-C 37.0
Vapor Pressure			
100° to 104° F, p.s.i.	64	50	22
Salting Out Temp. F	5°	34°	6°
Lbs. Water/Unit of N	11.0	7.8	21.0
Lbs. Water/5 Lbs. NH_3	3.4	2.9	6.5

Temperatures of the product as dumped in storage 11 a.m. were 114° to 120° F. Later in the day, 3 p.m., temperatures as low as 102° F. were observed. Over night, the exterior of the pile cooled, and the interior showed no temperature rise. The product was very free flowing, and free from pile set. Later observations showed less pile set than had previously been experienced with a similar grade formulated with an ammonium nitrate solution. A bag storage test was made with product less than one hour after granulation, piling 14 bags high, product temperature estimated at 100° to 105° F. At the end of three weeks there was comparatively little set. The slight form set was easily broken up, and the product was free flowing, free from hard lumps. Granule hardness was judged to be quite satisfactory.

In another plant scale test, two grades, a 12-12-12 and a 5-20-10, were tried with UAL-A. The process was again a modified TVA design, with ammoniator-granulator and co-current dryer. There was no cooler. In the 12-12-12, 7.5 units of N were derived from UAL-A and 1.5 units from solid urea, this combination being equivalent to 9.0 units from UAL-B. In the 5-20-10, all of the nitrogen was derived from UAL-A, and a small amount of calcium oxide and sulfuric acid was included to provide additional heat. The formulas are listed in Table 6.

Granulation of the 12-12-12 was started at 10T/hour, and after one hour stepped up to 15 T/hour. Product from the ammoniator was estimated at 200 to 225° F, and had a moisture content of 5.8 to 7.1%. Product



JEFFERSON LAKE
Bright Canary Yellow
CRUDE SULPHUR
99.5% MINIMUM PURITY
Produced by our
3 MINES IN TEXAS and LOUISIANA
and our
SULPHUR RECOVERY PLANT - MANDERSON, WYOMING
•
Carload Shipments
MOLTEN - FLAKED - LUMP
JEFFERSON LAKE SULPHUR COMPANY
General Offices - Whitney Building
NEW ORLEANS, LOUISIANA

1-1½-2-2½-3-3½-4-5-6-6½-10-12

gallon capacities
—ALL these SIZES

VULCAN®

STEEL PAILS and DRUMS
***available* FROM STOCK**
Prompt
Large or Small
Shipments—
of all Trade Styles

The huge Vulcan Warehouse is filled with ample stocks of each size and each style of standard trade containers—constantly being replenished as shipments move out daily by truck, rail and customer vehicle. No waiting for needed containers—no delays in pick-ups or deliveries. Manufacturing a complete line of sturdy steel shipping containers is Vulcan's sole business interest. Individualized customer service in shipping the desired quantities at the specified times is followed systematically. You can always depend upon Vulcan quality and Vulcan service, regardless of size of order.

Hi-Bake
Protective Linings

Available with any style drum or pail for edible or "hard-to-hold" products. Linings are specified and repeatedly tested by our laboratories, and are applied only under the control of scientific instruments.

Samples gladly sent upon request

Over 35 Years of Top Quality Containers

VULCAN CONTAINERS INC.

P.O. Box 161-K Bellwood, Illinois (Chicago Suburb)
Phone: Linden 4-5000

Representatives in Principal Cities
In Toronto, Canada—Vulcan Containers Limited

"It's Better to Ship in Steel"

Books for Sale

Soils and Fertilizers

by F. E. Bear

375 pages, price $6.00

This text presents the basic scientific facts and principles behind the production and utilization of agricultural chemicals. The why, when, where and how of fertilizers is expressly discussed, with particular emphasis on the importance of lime and fertilizer materials in maintaining and increasing the productivity of soils.

Chemistry and Uses of Insecticides

by E. R. de Ong

445 pages, price $6.75

Written by an outstanding student of entomology and agricultural technology, this book covers all the major insecticidal agents in detail, describing not only their chemical nature and properties, but also their specific action on various types of insects, their methods of application, and their effect on animals and humans.

Soils and Soil Fertility

by L. M. Thompson

330 pages, price $5.00

This authoritative treatment begins by telling what soil is — what makes it up physically, chemically, biologically —and what its moisture-holding characteristics are. The use of commercial fertilizers and farm manure are other subjects under discussion.

Order direct from

Agricultural Chemicals

P. O. Box 31

Caldwell, New Jersey

from the dryer had a temperature of 195° F, and a moisture content of 0.6% to 0.9%. Yield was estimated at 60 to 67%, —6+20 mesh. In general, good granulation was secured, but some difficulty was experienced in maintaining the optimum granulating conditions in the ammoniator-granulator. Control of water added was not as good as could be desired, and the amount of water in the formulation appeared to be too close to the critical amount to allow adjustment by added water. The product in storage was very free flowing, and had good granule characteristics. The surface of the pile cooled rapidly, but the interior appeared to increase in temperature (over 160° F) with a distinct odor of ammonia. Rehandling and moving the product brought down the temperature so that no further free ammonia could be detected. It was quite apparent from this test that to make and store this grade successfully cooling is necessary.

The 5-20-10 grade proved to be difficult to granulate with UAL-A (as it had been with other solutions), and repeated runs varying the amount of water produced erratic granulation, the material becoming alternately too dry or too wet. It was concluded that for this grade, the amount of urea (71.5 lbs./T) was insufficient for good granulation.

In another plant test, UAL-B was used in completely different equipment making 5-20-20 formulated with all N from UAL-B; a 5-20-20 with 3 units from UAL-B and 2 units from anhydrous ammonia, plus sulfuric acid; and a 12-12-12, 7.2 units from UAL-B and 4.8 units from ammonium sulfate, plus sulfuric acid. Granulation was satisfactory, but no data or analyses are available.

As indicated at the beginning, the work reported here was concerned principally with the question of urea hydrolysis under conditions of high ammoniation rates and granulation. The properties of urea do not preclude its consideration in granulating processes. From the standpoint of solubilities, urea is close to ammonium nitrate, and therefore affords a good agglomerating and adhesive effect. Only slight modification in formulating might be necessary in some cases to utilize UAL in any process now employing nitrate solutions.

In conclusion, we believe that this exploratory work has shown:

(1) that urea is stable in granulating processes involving high temperatures, provided the product is cooled before storage.

(2) that urea solutions afford satisfactory granulation from the standpoint of yield, desirable granule size, hardness of granule, appearance, free-flowing qualities, and comparative freedom from subsequent reactions that may induce excessive pile set or caking in bag storage.★★

GRANULATION FACTORS

(*From Page 36*)

tent with a given heat input, but results in substantially higher fertilizer ex-dryer temperatures, and is more likely to cause reduction of nitrates, with resulting evolution of nitrous oxide. In the summary above, there is less than 50° decrease in fertilizer temperature in the cooler. In an Eastern States granulation unit having counter-current air flow and similar air volume and fuel consumption, the fertilizer dryer discharge temperature ranges between 225° and 260° F, but the fertilizer decreases approximately 100° in the cooler. With these temperatures, agglomeration tends to occur in the cooler.

Cooler

REDUCTION of fertilizer temperature in the cooler is a result of transfer of heat from the granules to air, and the evaporation of limited amounts of moisture. The principles of the fertilizer rotary cooler, as first developed by Keenen and associates of the DuPont Co., are applicable today. With less moisture in granular fertilizer to evaporate in the cooler, there is less reduction of temperature of fertilizer per given volume of air. By study of air flow, air volume, air temperature, fertilizer temperature and fertilizer moisture,

SER-X

The Test Proven Insecticide Diluent

SUMMIT FOR TOP QUALITY

Formulators Report Excellent Results

...Excellent drift Control Properties
...Better Flowability
...Neutral pH
...Desirable Suspension Properties
...Controlled Bag Weights
...Readily Compatible

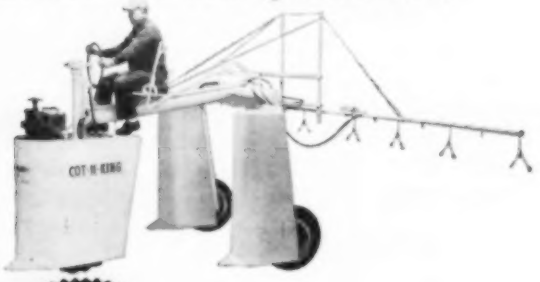
For Technical Literature and Samples, Write Dept. AC 1

SUMMIT MINING CORPORATION

BASHORE BUILDING CARLISLE, PENNSYLVANIA

Now for the first time

A HIGH CLEARANCE SPRAYER DESIGNED EXCLUSIVELY FOR *Cotton!*



The NEW

Finco

COT-N-KING

insures your cotton profit from planting to picking

- High clearance...up to 6½ feet boom clearance.
- Four-speed transmission.
- Choice of engines—8 HP or 14 HP.
- Adjustable boom.
- All controls within reach of driver.
- Heavy weight tubular construction.
- Choice of spray nozzles.
- Proven units—oldest high clearance manufacturer.
- Adjustable row spacings—36", 38", 40", 42".
- Cotton fenders on all wheels and tanks.
- Larger front-drive wheel.
- Full left or right 90° steering.
- Proven gear pump and pressure regulator.
- Tanks on both rear wheels for perfect balance.

Not a redesign or adaptation...but an all new, especially engineered unit, developed to meet the specific needs of cotton growers.

Finco, Inc., one of the country's oldest and largest manufacturers of high clearance sprayers spent months of careful field research with cotton growers, chemical makers, custom sprayers and U.S.D.A. representatives...then designed the COT-N-KING to meet their exacting needs...encompassing operating speed and efficiency, rugged construction, maximum safety, reduced maintenance, and low initial costs.

WRITE TODAY FOR FREE BROCHURE

***Finco* COT-N-KING**

SELF-PROPELLED, HIGH CLEARANCE SPRAYER

Produced in the cotton belt

FINCO, Inc.
Box 575, Greenville 4, Miss.
Please send me complete information on your new, field-proved COT-N-KING.

- ☐ I am a cotton grower
- ☐ I am a custom sprayer
- ☐ I am interested in a dealership

Name.....

Address.....

City.....*Zone*...*State*.....

REPUBLIC SULPHATE OF AMMONIA

AVAILABLE BULK OR BAGGED —IN CARLOAD LOTS

Republic top-analysis Sulphate of Ammonia is available in bulk form for mixing your own high nitrogen fertilizer blends. Or bagged for direct application.

Republic is one of the largest producers of Sulphate of Ammonia. This means you get prompt delivery at regular intervals to meet your needs.

Stock up now on Republic Sulphate of Ammonia. Call or write:

REPUBLIC STEEL

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC STEEL

Approximate Temperatures & Moistures of Mixed Fertilizer During Granulation

Fertilizer in	8 - 10% N		5 - 6% N	
	°F	% H_2O	°F	% H_2O
Mixer	200	6-7	170	10-12
Granulator	190	5-6	165	9-11
Dryer discharge (co-current)	175	2-3	160	3-4
Cooler discharge	130	1.5-2.0	120	2.5-3.0

maximum efficiency of a cooler can be determined. Granulation has accentuated one factor and that is time. Increased time during which fertilizer is in the cooler encourages the transfer of heat to the surface of granules and then transfer to the air.

Typical Moisture and Temperature

IT may be helpful to summarize what can be considered approximate moisture and temperature levels at several locations in the process, which contribute to granulation. Formulation and other factors affect these figures.

Control

UNIFORMITY of granular product is important. An unsatisfactory granular product can be more objectionable than pulverized fertilizer. Lack of control of temperature and moisture levels is likely to result in unsatisfactory granular fertilizer. Control methods and equipment which can be used include the following:

1. Cenco Moisture Balance—This inexpensive instrument enables moisture determinations within 15 minutes following sampling. Plant personnel can operate it. Use of this instrument at the plant provides opportunity for adjustments in formulation, dryer heat input and dryer air volume before a large tonnage too high in moisture is mixed and placed in the storage bin. It is important to correlate the determination with the method of moisture determination being used in the laboratory.

2. Potentiometer — Opportunity to conveniently and accurately determine temperatures at strategic locations in the process is important. Single thermocouples, with or without recording instruments, can be installed. A satisfactory and economical method of obtaining continuous temperature records is by installation of a multi-record strip chart electronic potentiometer. With a six point recorder, thermocouples might be located to obtain temperatures of the following:

a. Fertilizer — mixer or granulator.
b. Fertilizer — ex-dryer.
c. Air — ex-dryer.
d. Fertilizer — ex-cooler.
e. Air — ex-cooler.
f. Air — ambient.

3. Electronic Proportioning Relay — With a uniform volume of air being exhausted through a dryer, the ex-dryer air temperature can serve as an accurate index of the fuel input necessary for satisfactory moisture reduction of a given grade. After obtaining sufficient temperature data on production of each grade in a given plant, it is possible to establish ex-dryer air temperatures by grade, which reflect satisfactory drying. Adjustment of fuel input can be done manually.

4. Control Laboratory — The control laboratory personnel can assist development and production personnel immeasurably during the development of a given process and the continued production of satisfactory granular fertilizer. Moisture determinations are included in the important information obtainable in the laboratory.

In final analysis, the most important method of control of temperature and moisture levels is through informed personnel. Plant supervisors and operating personnel who have adequate information on temperature and moisture relationships, and who are guided in the effective operation of their granulation equipment, have an advantage in the production of quality fertilizer.★★

IT'S HERE - IT'S PROVEN

ITS Y-M CO'S. 500 LB. PORTABLE CUT-BACK DUST BLENDING SYSTEM

Capacity — Four to six 500 lb. batches per hour

Space Requirement — 6'6" x 10'6" x 15' O. A. Ht.

DELIVERED TO YOU—READY TO OPERATE
System Includes **— Dust hood at loading station; Sifter; Pre-Mixer at floor level; Pneumatic Conveyor-Blender; After-Mixer with dust collector; Dust hood at packaging station, etc; All motors wired to panel box with push button controls.**

WRITE OR PHONE
YOUNG MACHINERY CO.
MUNCY, PA. TODAY!

Young machinery

Muncy, Pennsylvania - - - 6-3509
Pasadena 8, Cal. - - - - - RYan 1-9373
Oakland 13, Cal. - - - - TEmplebar 2-5391

Export Sales Reps.:
Mercantile Development, Inc.
50 Church St., New York 7 - - BArclay 7-4789

PRESTO FLOWER POT WASHER FOR *Sterile-Clean* POTS

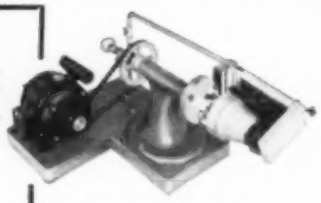
SATISFIED PRESTO USERS INCLUDE:

Experimental Stations . . .
Naugatuck Chemical Company — Merck & Co.
U.S. Department of Agriculture — Shell Oil Co.

Leading Schools and Colleges . . .
Cornell University — University of California
Iowa State College — University of Illinois

Municipalities . . .
Brooklyn, N. Y. — Pittsburgh, Pa.
New Orleans, La. — Santa Monica, Calif.

Commercial Growers . . .
Alberts & Merkel Bros., Inc.
Boynton Beach, Florida
Corliss Bros., Inc., Glouster, Mass.
Dos Pueblos Orchid Co., Goleta, Calif.
Wilson's Nurseries Ltd., Hastings, New Zealand



The improved PRESTO has leakproof ball bearings, automatic alignment of brushes, valve regulated water supply.

- *Gives a clean root ball for shipping*
- *No broken feeder roots in transplanting*
- *No set-back in growth, causing loss of market*

Sterile-clean pots are better than new. PRESTO removes all dirt, debris and fungi . . . cleans pots inside and out in one easy operation.

Write for circular and price list.

PRESTO **MANUFACTURING COMPANY**
366 Bassett Rd., Dept. AC • Bay Village, O.

Pyrethrum? Allethrin? *ask* MGK

As acknowledged pioneers and recognized authorities in the correct use of pyrethrum, allethrin and their most effective synergists, MGK 264 and piperonyl butoxide, we offer standardized concentrates, extracts, dusts of guaranteed uniformity.

If your aerosols, sprays, or dusts include the use of the powerful, safe and spectacular knockdown agents, pyrethrum and allethrin, send your inquiry today. All requests for information answered by qualified authorities. Write.

McLAUGHLIN GORMLEY KING *Company*
1711 S.E. Fifth Street • Minneapolis, Minnesota

WISCONSIN ALUMNI RESEARCH FOUNDATION

LABORATORY SERVICES

Peet-Grady and C.S.M.A. aerosol tests
Biological evaluation of insecticides
Screening of compounds for insecticidal, fungicidal, and bactericidal properties
Bioassay of insecticide residues on crops
Chemical determination of insecticides
Phenol coefficient determinations
Mineral determinations including fluorine and other trace elements
Pharmacology including warm-blooded toxicity studies
Warfarin assays — physico-chemical and biological
Other biological, chemical, and microbiological services

PROJECT RESEARCH AND CONSULTATION

Write for Price Schedule

WISCONSIN ALUMNI RESEARCH FOUNDATION
P.O. Box 2059-B • Madison 1, Wisconsin

A McDERMOTT
DRYER 8' x 50'
COOLER 8' x 40'
AMMONIATOR 7' x 7'
for a large granulated fertilizer plant
McDERMOTT BROS., CO.
Established 1895
Allentown, Pennsylvania

SULFURIC ACID

(From Page 40)

AT PRESENT about 100 out of a total of 213 superphosphate plants have co-existing acid facilities. Some superphosphate manufacturers also obtain their acid requirements from the spent acid of the petroleum and explosives industries, and some get acid from ore smelters. As has been mentioned, the superphosphate industry operates on a narrow margin of profit, producing a low-cost commodity, and therefore must take advantage of every possible factor to keep the unit production cost down. The location of a plant close to a cheap, dependable source of acid is a distinct advantage. That, for example, is why so many superphosphate plants are located not far from the great Copper Hill plant of the Tennessee Corporation. The acid manufacturer starts production with sulfur dioxide. He burns brimstone or roasts pyrites to get the initial sulfur dioxide. Many ore smelters already have sulfur dioxide in sufficient strength in their gases to permit recovery and conversion to sulfuric acid. Some of these smelters produce superphosphate as a means of profitably utilizing such waste gases.

Sulfur is recognized as one of the essential plant nutrients. Until recently, many agronomists took sulfur for granted. Recent investigations, however, have shown that in many soils here and abroad sulfur is deficient and has to be replenished to maintain crop yields. It is not fully appreciated in all quarters that the superphosphate industry has made a generous contribution to agriculture's sulfur requirements wherever its product has been used as a fertilizer. In the reaction between rock phosphate and sulfuric acid about half the weight of the resultant superphosphate is calcium sulfate. In other words, about 12 per cent of normal superphosphate is sulfur capable of feeding plants. The use of calcium sulfate or gypsum in agriculture as a source of calcium and sulfur is one of the oldest established practices. Benjamin Franklin was one of the first to sponsor it in our country. The superphosphate industry, strange to say, has in its sales efforts emphasized the phosphorus but ignored the sulfur portion of its product.

TABLE 3

Sulfuric Acid Consumed by Fertilizer Industry in the United States (100% Basis), Short tons and Percentage of Total*

Year	Short tons	Percentage of Total Consumed
1939	1,225,000	24.6
1940	1,410,000	24.6
1943	2,500,000	28.8
1945	2,850,000	31.1
1950	4,990,000**	40.
1951	5,144,000**	41.5
1952	5,285,000	42.7
1953	5,200,000	40.0
1954 (est.)	5,380,000	40.5

*Source: Based on **Chemical Engineering** and **C. & E. News.**

**Includes 1,200,000 tons estimated for ammonium sulfate production.

Recognition should be given to this sulfur content. Farmers and agricultural workers should be made aware of its importance. Some persons clamor for higher analysis materials. To produce these it is often necessary to refine to a very high degree. For example, many insist on having a 48 per cent concentrated superphosphate in place of a 20 per cent grade. To produce the concentrated form by the wet process the manufacturer removes all the calcium sulfate portion, leaving virtually nothing but monocalcium phosphate. If concentrated were to supplant the 20 per cent grade, it would not be long before the soil in many parts of the country might become seriously low in sulfur, which would have to be applied separately as a nutrient. This sort of thing has occurred with potash salts: as kainit and other manure salts containing magnesia were replaced by refined, high grade muriate, it became necessary to apply magnesia to the depleted soils.

Other fertilizer materials, of course, contain sulfur and help maintain sulfur supplies in soils. Among those used in large quantities are sulfate of ammonia with a sulfur trioxide content of about 60 per cent (59.67 per cent); sulfate of potash-

ARE YOU USING THIS

Proven Carrier

IN THE FAST GROWING FIELD OF

GRANULAR INSECTICIDES and HERBICIDES?

Terra-Lite® BRAND VERMICULITE

The use of granular toxicants for the control of insects and weeds is growing at a rapid rate. Terra-Lite brand vermiculite has already proven itself an ideal carrier. Two Terra-Lite "plus benefits" which will be major factors in further broadening this "new market" are: ease of application and the use of conventional equipment. Before deciding on your formulating plans in the granular field, consider the following other advantages of Terra-Lite vermiculite:

- **Lower carrier cost per lb. of finished product.**
- **Over 27,500,000 particles per lb. (28/65 mesh).**
- **High absorbency — free flowing even when high concentrations are formulated.**
- **Practically non-reactive.**
- **Release of toxicant is assured regardless of soil moisture conditions.**
- **Quick service—available from over 40 plants.**

Terra-Lite®

Division of Zonolite Company
135 S. LaSalle St., Chicago 3, Illinois

SEND COUPON TODAY

Terra-Lite, Dept. AC16, Division Zonolite Company, 135 S. LaSalle St., Chicago 3, Ill.

Please send latest data on commercial use of Terra-Lite vermiculite and also actual samples, as checked:

☐ FREE INSPECTION SAMPLE
☐ FREE WORKING SAMPLE

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE____

"America's No. 1 Bag Maker"

General Offices—St. Louis 2, Mo.
Sales Offices in Principal Cities

Sell TURF-ORGANIC
For Everything That Grows...

- Cannot burn. Needs no "watering in".
- Will not cake or crust. Use any time, any place.
- Granular, not powdered. Easy to apply.
- Proved on golf courses, parks and estates.
- Gives superior turf at minimum cost.

Distributors & Dealers:
Ask about Lebanon's big profit opportunities and free promotional aids. See us in Booth 743 at the Eastern Garden Supply Trade Show.

LEBANON

Lebanon CHEMICAL CORPORATION
LEBANON, PA.

MEETS EVERY TEST

Uniformity · Service · Reliability · Quality

BELL KAOLIN

from the fully mechanized BELL MINE *in* Batesburg, S. C.

Distributed by
WHITTAKER CLARK & DANIELS, INC.

"The Talc House"
260 West Broadway
New York 13, N. Y.

PRODUCERS AND PROCESSORS
OF

HIGHEST QUALITY KENCO INDUSTRIAL MINERALS

FOR

INSECTICIDE DUST

KENNEDY MINERALS, CO., INC.
2550 East Olympic Blvd.
Los Angeles 23, California

magnesia, with about 57 per cent SO_3 (56.76 per cent); and 16-20 amonium phosphate-sulfate, with about 39 per cent SO_3 (38.49 per cent). Normal superphosphate, by the way, has 29.09 per cent SO_3.

Evidently, then, sulfur occupies an important place in the fertilizer industry (table 3). It is closely linked with the manufacture of superphosphate, for which about 4 million tons 100 per cent basis sulfuric acid is used annually, and with such other fertilizer materials as sulfate of amonia 16-20 ammonium phosphate-sulfate, and sulfate of potash.

It has been estimated that one in every three tons of sulfur is returned to the soil in various forms and ways to promote crop growth. Sulfur is one of the major plant nutrients. Although the sulfur content of plants is generally less than that of the primary nutrients, (nitrogen, phosphorus, and potassium), it is large enough to make it a major plant nutrient. It is a constituent of all proteins in which it varies from about 0.17 to 1.09 per cent. The richer the plant is in proteins, the greater the need of sulfur. (cereals and legumes.) As measured by crop needs, generally the sulfur supply in the soil is about equal to the phosphorous supply. But if we consider the need of high-sulfur crops like legumes and the crucifers, then the amount of sulfur usually present in a soil is relatively lower than phosphorus. Sulfur in the form of sulfate leaches readily out of the soil whereas phosphorus is fixed and held tenaciously. Hence, in many instances, it is quite possible that the good results reported from an application of normal superphosphate could be attributed as much to the sulfur as the phosphorus. For this same reason agronomists are coming to prefer the use of concentrated 45% superphosphate in all phosphorus test plots in place of normal 20% superphosphate so as to avoid the influence of the sulfur factor, since the concentrated superphosphate contains little if any sulfur.★★

The author is indebted to Robert Frank of Chemical Construction Corporation, New York, and to T. R. Harvey of Monsanto Chemical Company, St. Louis, for many helpful suggestions.

PROFESSIONAL *Directory*

MOntclair 3-2598

DONALD F. STARR, PH. D.
CONSULTING CHEMIST
256 NORTH MOUNTAIN AVE.
UPPER MONTCLAIR, N. J.
Insecticides
Aerosols-Rodenticides
Fish Control Agricultural Chemicals

FLORIDA FIELD TRIALS
Evaluations
of
Agricultural Chemicals.
DR. G. R. TOWNSEND
Box 356
Belle Glade, Florida

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist
(Formerly Director of Science, Government of the Philippine Islands. Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)
ADVISER ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS
Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.
1118 Emerson Street
Palo Alto, California

FRIAR M. THOMPSON, JR.
Consultant
Specializing in insecticides, rodenticides, fungicides, weed controllers for industry, household, and farm.
Product formulation, testing, labeling.
Athens, Georgia

Theodore Riedeburg Associates
Sales Consultants
and
Manufacturers' Representatives
on
Agricultural Chemicals
415 Lexington Ave.
New York 17, New York
MU rray Hill 7-1488

SOIL & PLANT TESTS
SOIL FERTILITY PROBLEMS
EVALUATION OF
AGRICULTURAL CHEMICALS
Dr. Wolf's Agricultural Laboratories
2620 Taylor St. Hollywood, Fla.

AC on Microfilm
All issues of AGRICULTURAL CHEMICALS are available on Microfilm.
Librarians and other interested subscribers can contact University Microfilms, 13 North First Street, Ann Arbor, Mich., for price information and copies.

E. H. SIEGLER, Ph. D.
(Formerly U. S. Department Agriculture)
Pesticide Consultant
Washington Representative
Preliminary appraisal of chemicals for control of pests of agricultural crops; field research with promising formulations for determination of pesticidal utility and residues; preparation of petitions for certification of usefulness.
201 Tulip Avenue, Takoma Park, 12,
WASHINGTON, D. C.
PHONE: JUNIPER 5-1555

HOW TO combat weeds . . .

check their introduction, spread, regrowth . . . effectively-economically

Here is an authoritative, thorough book that gives you all the data and practical help you need to prepare—and carry out—a tested, efficient, successful method of attack on any weed in any location quickly and effectively. Based on experience, research and experiment, it shows what methods of weed control have been proven most effective for weeds of all species—from crab grass to wild mustard — points out what methods can be applied economically in certain areas—shows how and when to apply a control measure, the season and rate of application, dosage, etc., and outlines the materials and machinery needed.

Quickly shows you how to eradicate

SPECIAL WEEDS
Bracken Fern
Canada Thistle
Horse Nettle
Nut Grass
Poison Ivy, Poison Sumac, Poison Oak
Prickly Pear
Quack Grass
Russian Thistle
Wild Garlic, Wild Onion

IN SPECIAL AREAS
meadow
pasture
range lands
lawns
golf greens and fairways
orchards
vineyards

WEED CONTROL

A Textbook and Manual

By WILFRED W. ROBBINS
ALDEN C. CRAFTS
and RICHARD N. RAYNOR
All at the College of Agriculture
University of California

543 pages, 6 x 9, 202 illustrations, charts, tables, $8.00

The book provides the farmer, horticulturist, greenskeeper, highway maintenance engineer, landscape gardener, etc., with a definite answer to his particular problem, indicating the methods that are especially adapted to meadow, grainfield, orchard, golf green, roadside, greenhouse, and other specific locations.

AGRICULTURAL CHEMICALS
P. O. Box 31 Caldwell, N. J.

WORLD'S LARGEST STOCK

UNION Rebuilt Machinery
Established 1912

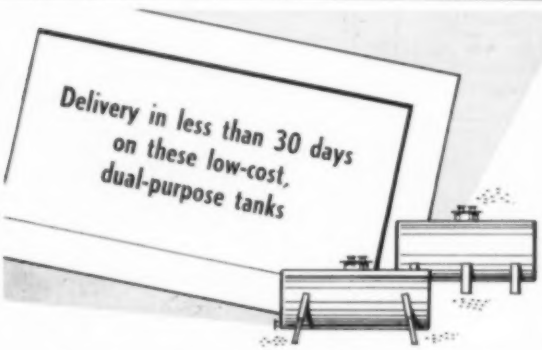
REBUILT & GUARANTEED MACHINERY AT GREAT SAVINGS

Brand New Standard Knapp Wraparound Labeler, in original crate.
Mikro 3TH, 2TH, 3W, 1SH, 1F Pulverizers.
J. H. Day Dry Powder Mixers, 50 to 10,000 lbs. cap.
Resina S and LC Automatic Cappers.
Burt 611 AUB and Knapp D Wraparound Labelers.
Day 650 gal. Steam Jacketed Jumbo Mixer.
Day, Robinson, Rotex, Tyler Hum-mer, Raymond, Great Western and Gayco Sifters.
Stokes and Smith B Auger Transwrap.
Stokes and Smith G1, G6, HG88 Duplex Auger Fillers.
Elgin, MRM Stainless Steel Fillers.
Pony, Ermold, World Semi and Fully Auto. Labelers.
Pneumatic high speed Auto. Cartoning Unit.
Package Machinery FA, FA", FA2 Auto. Wrappers.
Hayssen, Scandia, Miller, Campbell, Oliver Wrappers.

IMMEDIATE DELIVERIES

Write, Wire, Phone Collect for Details and Prices

UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St. New York 12, N. Y.



Solve liquid fertilizer storage problems quickly, economically and efficiently. A&C rubber-lined tanks are ready for prompt delivery. They assure complete corrosion protection from both phosphoric acid and nitrogen solutions . . . cost far less than any other type of dual-purpose tank. Send coupon for complete information today!

ABRASION & CORROSION ENGINEERING COMPANY
P. O. BOX 3568 AMARILLO, TEXAS

Abrasion and Corrosion Engineering Company
P. O. Box 3568, Amarillo, Texas

Gentlemen:
Without obligation, please send me complete information on low-cost A&C rubber-lined tanks.

Name_____
Company_____
Address_____
City_____ Zone_____ State_____

Lancaster, Allwine & Rommel
Registered Patent Attorneys
Suite 428,
815—15th STREET, N. W.
Washington 5, D. C.

Patent Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions.

Booklet and form "Evidence of Conception" forwarded upon request.

Classified ADVERTISING

Rates for classified advertisments are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. *Check must accompany all classified advertisments.* Address all replies to Classified Advertisements with Box Number care of AGRICULTURAL CHEMICALS, P. O. Box 31, Caldwell, N. J. Closing date: 10th of preceding month.

Situations Wanted:

AGRONOMIST - TECHNICAL SALESMAN: Agronomist with background in soils, fertilizers and agricultural chemicals seeks better opportunity. Farm background, college degrees, 5 years successful commercial experience. Address Box 104, c/o Agricultural Chemicals.

CAPABLE, alert young man, M.S. in Agronomy, age 33, married, extensive experience in domestic, foreign and tropical agricultural field, desires opportunity with progressive concern. Technical, liaison, sales position preferred. Address Box 103, c/o Agricultural Chemicals.

Help Wanted:

PRODUCT SALES MANAGER

(Entomologist)

$6000-$9000 Salary

(Fully paid insurance and Pension Plan)

Unusual career opportunity with a national Chemical Manufacturer for experienced entomologist under 38 years of age with college degree.

Must have proven record and experience in household and livestock insecticide sales.

Our client's employees know of this advertisement.

Send two copies of your resume, in confidence to

Jack Lewis
Accredited Personnel Service
12 S. 12th Street, Philadelphia 7, Pa.
Phone Walnut 2-4460

POSITION OPEN: for young man with initiative and responsibility with a major West Coast manufacturer of pesticides for formulation development, field testing and service, contacts with public research men, label preparation, etc. Requires basic training in entomology and chemistry. Send personal data, including photograph, as well as complete information as to education, training, experience, etc. Address Box 105, c/o Agricultural Chemicals.

TECHNICAL COPYWRITER: for large West Coast chemical corporation. Top college graduate with agronomy or plant pathology major. Should have 5-7 years experience with fertilizer company or equivalent selling, writing advertising copy, folders etc. Must understand fertilizer business to reach farmers, dealers and consumers via all media. Address Box 106, c/o Agricultural Chemicals.

JR. COPYWRITER: for commercial fertilizers. College graduate with at least 3 years business experience. Sales promotion experience or advertising production background helpful. Address Box 107, c/o Agricultural Chemicals.

For Sale:

FOR SALE: Equipment in Deepwater, N. J.—Sturtevant 8" x 10" Jaw Crusher; Hardinge 6' dia. x 22" long Conical Ball Mill; Hardinge Ruggles Coles XC-2 Rotary Steam Tube Dryer 4' dia. x 30' long; (2) Link Belt Bucket Elevators 31' and 32' high; (4) Jeffrey Suspended type steel feed hoppers 150 cu. ft. and 240 cu. ft., with Howe Scales; (2) Screw Conveyors 9" dia. x 10' L and 22' L; Dracco Automatic Dust Filter Collector with 3 bag filter compartments; (2) Link Belt Bulk-Flo Drag Conveyors size 55—24' and 34' long. Will sell all or part. Perry Equipment Corp., 1428 S. 6th St., Phila. 22, Pa.

DON'T TAKE CHANCES

with toxic insecticides and fumigants such as Systox, Parathion, TEPP, Aldrin, Chlordane, etc.

WILLSON AGRI-TOX RESPIRATOR

USDA accepted Willson Agri-Tox is the universal respirator for handling and applying toxic farm chemicals. Write for bulletin, prices and name of your nearest distributor.

WILLSON®

Leaders in Research and Development of Safety Equipment Since 1870

116 Thorn Street, Reading, Pennsylvania

Too Late to Classify:

AGRICULTURIST: Ph.D. candidate in Agronoy, Botany, and Plant Biochemistry. Specialization in chemical weed control, training in entomology and plant pathology. Commercial research and development experience with broad pesticide field. Desires technical or sales development post commercial firm, U. S. or Canada. Single, prepared to travel. Address Box 108, c/o Agricultural Chemicals.

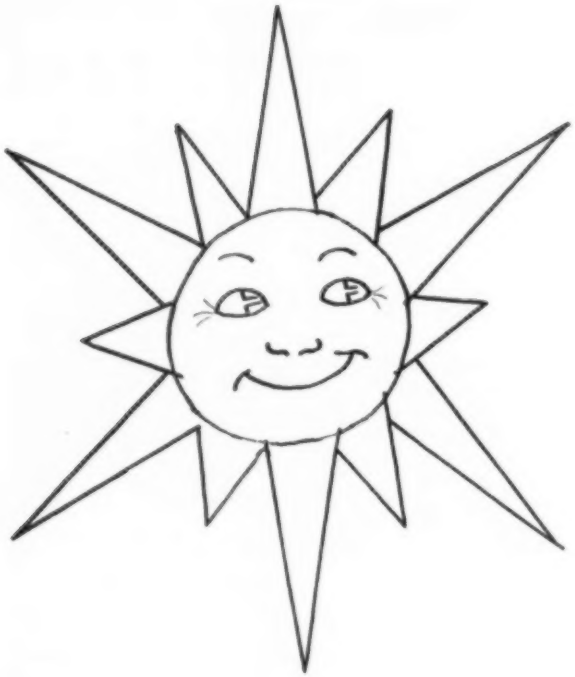
Want a good man? . . . or a good job?

Have you something to sell?

Looking for something to buy? . . .

Run a classified ad in the largest classified section for the agricultural chemicals industry . . . in the pages of AGRICULTURAL CHEMICALS MAGAZINE.

Rates are low . . . results are fast, because you reach the market you are interested in.



Hollywood Beach, Florida

Meet Your Friends and Business Associates
At Hollywood Beach, Florida, during the

SPRING MEETING

OF

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION

MARCH 14-18

- **Learn the Latest Industry Developments**
- **Plan Now to Attend**

For Complete Information Write

The Executive Secretary
National Agricultural Chemicals Assoc.
603-4 Associations Building
1145 19th Streets, N.W.
Washington 6, D. C.

Illinois Training School

A joint meeting of the Agricultural Spraying Association and the Illinois Aerial Applicators' Association was scheduled for the three day meeting of the Ace Customs Spray Operations Training School held January 25-27 at the University of Illinois, Urbana, Ill.

The sponsors of this annual training school are the University of Illinois, Extension Service in Agriculture, and the Illinois Natural History Survey. H. B. Mills, Frank B. Lanham and Harold H. Gordon were to preside at various sessions of the conference.

H. B. Petty was to review the insect situation for 1956, and continuing the discussion of pesticide problems was a report on "Insecticide Tolerances and the Miller Bill" by George C. Decker. Stephen Moore gave a report on some general insect problems while specific information on corn borer control, using granular DDT was reported by T. A. Brindley and W. H. Luckman. Some of the latest information on soil insecticides were reviewed by J. H. Bigger.

In connection with soil and fertilizer problems, Wendell Bowers was to present a report on "Equipment Problems with Liquid Fertilizer Applications." L. L. Coulter was scheduled to review "New Developments in Brush Control," and E. C. Spurrier to discuss "Livestock Poisoning from Weed Chemicals." The question of safety in application and use of insecticides was to be reviewed in a report by N. G. P. Krausz on "Operator Liability."

•

Ag Engineers Name Bainer

Roy Bainer has been nominated president of the American Society of Agricultural Engineers for the year 1956-57. The announcement was made at the close of their recent winter meeting in Chicago. Bainer, professor and chairman of the department of Agricultural Engineering, University of California, will be installed in his new office in June at the annual meeting at Roanoke, Virginia.

A record number of agricultural engineers from all parts of the U. S. and Canada were registered. Over 1150 engineers took part in various discussions, including such topics as power and machinery, farm structures, soil and water, and rural electrification.

* * * *

New Laboratory for Davison

The expanding research activities of the Davison Chemical Company Division of W. R. Grace & Co. are to be housed in a new laboratory near Baltimore scheduled for completion in 1956. Approximately 52,000 square feet in total area, the three story building will provide for a staff of 160. The 148-acre site is located about midway between Baltimore and Washington.

Present Davison research activities are largely centered at the division's Curtis Bay Works in Baltimore. Process engineering research will continue at Curtis Bay, while other departments that will be transferred to the new laboratory include: research management, chemical research, agricultural research, catalyst research, nuclear research and new products development.

•

Bemis Reorganizes Eastern Div.

Bemis Bro. Bag Co., St. Louis, is reorganizing and moving certain of its manufacturing operations in the East. This move will involve closing the company's Brooklyn plant and dividing its production among other Bemis plants serving the area.

Bemis will continue to maintain a sales and office force, to operate as the Brooklyn Sales Division, serving the New England States and portions of New York, New Jersey and Pennsylvania. J. V. Richards will continue as manager of this sales division.

Delivery of textile bags, specialties and other Bemis products in the territory previously served by the Brooklyn plant will be divided among Bemis plants at Norfolk, Buffalo, New Orleans, Memphis, East Pepperell, Mass., Albion, N. Y., and Crossett, Ark. It is anticipated that another plant, designed for certain specific products, will shortly be established in the area.

Don't Let This Happen To You!

The filly-loo bird above didn't realize the value of a

- non-burning
- long lasting
- non-leaching
- economical

38% Urea-Form Nitrogen in his formula.

NITRO-FORM

Division of Woonsocket Color & Chemical Co.
WOONSOCKET, R. I.

SOLE SELLING AGENT:
H. J. BAKER & BRO.
600 FIFTH AVENUE
NEW YORK 20, N. Y.

IMPORTANT!

Special Convention Issue

of

AGRICULTURAL CHEMICALS

to be brought out at the annual spring meeting of the

NATIONAL AGRICULTURAL CHEMICALS ASSN.

With the opening of another growing season just around the corner, why not get under way with your plans to share in a bigger way in this market during 1956? A special advertisement in the March issue of AGRICULTURAL CHEMICALS can bring your sales message to the attention of top executives in the industry as they put the final touches on their own marketing plans for the coming season.

Advertising Deadline for the March Issue is February 5

AGRICULTURAL CHEMICALS

Box 31 **Caldwell, N. J.**

Index to ADVERTISERS

Abrasion & Corrosion Engineering Co. 128
African Pyrethrum Development, Inc. 78
Thos. Alabama Kaolin Co. ..... Jan.
American Agricultural Chemical Co. 88
American Cyanamid Co. 28
American Potash & Chemical Corp. 54
W. R. E. Andrews Sales, Inc. 109
Antara Chemical Div., General Dyestuff Corp. 76
Armour and Co. 17
Ashcraft-Wilkinson Co. 24
Atlantic Refining Co. ..... Jan.
Atlas Powder Co. ..... Dec.
Atkins, Kroll & Co. 112

Bagpak Div., International Paper Co. 10
Bell Clay Co. 126
Bemis Bro. Bag Co. 126
Berkshire Chemicals, Inc. 111
Blaw Knox Co. 23
Bradley & Baker ..... Jan.
Bradley Pulverizer Co. ..... Dec.
Burlap Council of Indian Jute Mills Assn. 104

California Spray Chem. Co. 118
Chemagro Corp. 108
Clark Equipment Co. ..... Jan.
Climax Molybdenum Co. 60
Columbia Southern Chemical Corp. ..... Jan.
Combustion Engineering, Inc., Raymond Division 18
Continental Can Co., Shellmar Betner Div. 100
Cox, Dr. Alvin J. 127

Davies Nitrate Co., Inc. 113
Davison Chemical Co., Div. of W. R. Grace & Co. 59
Deere & Co., Grand River Chem. Div. 22
Diamond Alkali Co. 106
Doane Agricultural Service Inc. ..... Jan.
Dorr-Oliver Co. 92
Dow Chemical Co. ..... Dec.
Duval Sulphur & Potash Co. 24

Eagle-Picher Co. ..... Nov.
Emulsol Corp. 7
Escambia Bay Chem. Corp. ..... Dec.

Fairfield Chemical Div., Food Machinery & Chemical Co. 63
Finco, Inc. 122
Floridin Co. 86
Fry Co., Geo. H. 117
Fulton Bag & Cotton Mills ..... Jan.

Geigy Chemical Co. ..... Jan.
General American Transportation Corp. 98
General Reduction Co. 102
Gerotor May Corp. 116
Glendon Pyrophyllite Co. 101
Grand River Chemical Division of Deere & Co. 22
Greeff & Co., R. W. ..... Jan.

Hardinge Co. 105
Heckathorn & Co. 97
Hercules Powder Co. ..... 4th Cover
Huber, J. M. Corp. 107
Hudson Pulp & Paper Corp. 15

International Minerals & Chemical Corp. 21, 73

Jefferson Lake Sulphur Co. 119
Johns-Manville Co. 26, 27
Johnson, C. S. & Co. ..... Jan.

Kennedy Minerals Co., Inc. 126
Kolker Chemical Co. 81
Koppers Co. ..... Dec.
Kraft Bag Co. ..... 3rd Cover

Lancaster, Allwine & Rommel 128
Lebanon Chemical Corp. 126
Lion Oil Co. 95
Lummus 66
Ludlow-Saylor Wire Cloth Co. ..... Oct.

McDermott Bros. Co. 124
McLaughlin Gormley King Co. 124
Michigan Chemical Corp. 103
Minerals & Chemicals Corp. of America 3, 19
Mississippi River Chemical Co. ..... Jan.
Monsanto Chemical Co. 20

Naugatuck Chemical Division, U. S. Rubber Co. 115
National Agricultural Chemicals Assn. 130
Ninol Laboratories, Inc. ..... Jan.
Nitrogen Div., Allied Chem. & Dye Corp. 12, 13
Nitroform Division, Woonsocket Color & Chemical Co. 131

Oldbury Electro Chemical Co. ..... Nov.
Olin Mathieson Chemical Corp. ..... 2nd Cover

Pacific Coast Borax Co. 14
Penick, S. B. & Co. ..... Jan.
Pennsylvania Industrial Chemical Corp. Dec.
Pennsylvania Salt Manufacturing Co. 74
Phelps Dodge Refining Corp. ..... Dec.
Phillips Chemical Co. ..... Jan.
Potash Company of America 9
Powell, John & Co. ..... 2nd Cover
Prentiss Drug & Chemical Co. 96
Presto Manufacturing Co. 124
Private Brands, Inc. ..... Jan.

Raymond Bag Co. 16
Raymond Division, Combustion Engineering, Inc. 18
Republic Steel Corp. 122
Renneburg & Sons Co., Edw. ..... Jan.
Reideburg, Theodore Associates 127
Rohm & Haas Co. 90

Shell Chemical Co. 8
Sohio Chemical Co. ..... Jan.
Southeastern Clay Co. ..... Jan.
Spencer Chemical Co. ..... Jan.
Spraying Systems Co. ..... Jan.
Squibb Taylor Inc. ..... Dec.
St. Regis Paper Co. ..... Dec.
Stauffer Chemical Co. 80
Stedman Foundry & Machine Co. ..... Jan.
Sturtevant Mill Corp. 11
Summit Mining Corp. 121

Tennessee Corp. 68
Texas Gulf Sulphur Co. 110
Townsend, Dr. G. R. 127

Union Bag & Paper Corp. 62
Union Special Machine Co. 25
Union Standard Equipment Co. 128
U. S. Phosphoric Products, Div., Tennessee Corp. 82
U. S. Potash Co. 84

Vanderbilt Co., R. T. ..... Jan.
Velsicol Chemical Co. 4
Vulcan Steel Container Co. 120

Williams Patent Crusher & Pulverizer Co. ..... Jan.
Willson Products Inc. 129
Wisconsin Alumni Research Foundation 124
Woodward & Dickerson, Inc. ..... Jan.
Woonsocket Color & Chemical Co., Nitroform Div. 131

Young Machinery Co. 123

Zonolite Co. 125

Tale Ends

IF you haven't already made your reservations for the annual spring meeting of the National Agricultural Chemicals Association, scheduled for March 14-16 at the Hollywood Beach Hotel, Hollywood, Fla., it's time to get on the ball. This is the first NAC gathering in Florida since the highly successful 1951 meeting at the Flamingo in Miami Beach, complete with water ballet, dog races, etc.

AC

Faces should wear more smiles at this year's spring convention than for many a season. 1955 was quite a good year, as compared with the previous two or three, and all the signs point to another substantial sales total for 1956—and perhaps even higher profit margins. The volume should certainly be there this season, for all the counts of hibernating insects are definitely on the high side.

AC

The inevitable is starting to happen in the anhydrous ammonia market. With productive capacity continuing to expand,—and gaining faster than demand, the price tone of the market is reported weakening. Major producers have dropped their basic quotations in a minor way, and some are reported offering further concessions by absorbing freight costs. Retailers have dropped their prices even more sharply, with some figures down as much as $30 a ton from 1955. Even though demand is still expanding, it may take several years for it to catch up with sharply expanded output,—and if new capacity continues to come into production who can guarantee that the gap can be closed at any early date?

Annual capacity for production of anhydrous ammonia was reported at 3,545,000 tons on January 1, 1956, an increase of 108% over January 1, 1951, when the big expansion in nitrogen plant capacity started. (See page 49 for further details).

AC

J. I. Rodale, long-time champion of organic gardening and foe of chemical fertilizers, insecticides, etc., is in again. In the January issue of Prevention, which he edits, he really goes to work on systemic insecticides, calling them "the biggest step yet taken toward race suicide through the sterilization of the reproductive functions of man." Noting "something sinister" in the wider use of these important new pesticidal aids to agriculture, he suggests that perhaps the developers of these new products have already been so affected from consuming "devitalized and poisoned food as a result of the products sold by their very own companies," that their mental powers have been affected and "they cannot clearly see the effect of what they are doing." Wonder what he will say when he hears about antibiotics.

AC

As a companion piece to this lugubrious view of the future, we are glad to be able to offer the reassuring news contained in a report on DDT ingestion by humans presented by three investigators of the U. S. Public Health Service at the recent meeting of the American Association for the Advancement of Science in Atlanta. For a full year fourteen men ate DDT in quantities sometimes 200 times as much as the amount an average person would get from his diet through residues on fruits and vegetables. No unfavorable symptoms were noted, and the researchers concluded that "there is a large safety factor associated with DDT as it now occurs in the general diet." Page Dr. Rodale.

Cold Reception

What kind of a reception do your salesmen get when they're out beating the brushes for new business? Does the buyer say: "Oh yes, Oliver Cuttlebone, of Flinthead & Sabertooth, A fine old firm?" . . . Or does he give them that cold stare that implies he never heard of them or their company?

If it's the cold shoulder they've been getting, why not try paving the way for them with an advertising program where it can do the most good . . . in the pages of

AGRICULTURAL CHEMICALS

Caldwell **New Jersey**

Member Audit Bureau of Circulations

Your best assurance for a *continuous* supply is a completely integrated supplier!

Kraft Bag Corporation comes closest to being the most completely integrated manufacturer of multiwall shipping sacks in the industry!

Check this chart and see for yourself why Kraft Bag Corporation should be your supplier!

Tell us when we may call to discuss your requirements.

FEATURES	KRAFT BAG CORPORATION	OTHER SOURCES ?
Forest Lands	✓	
Pulp Mill	✓	
Bleach Plant	✓	
Paper Mill	✓	
Multiple Bag Plants	✓	
Natural Kraft	✓	
Colored Kraft	✓	
Bleached Kraft	✓	
Creped Kraft	✓	
Wax Laminated Kraft	✓	
Asphalt Laminated Kraft	✓	
Wet-Strength Kraft	✓	
Water Repellent Kraft	✓	
Stak-LOK Super Rough Kraft	✓	
Valve Bags—sewn or pasted	✓	
Open Mouth Bags—sewn or pasted	✓	
Flat Sewn Valve Bags	✓	
Flat Sewn Open Mouth Bags	✓	
KRAFT-lok Valve Closure	✓	
Creped Tape	✓	
Gummed Tape	✓	
Filter Cord	✓	
Sewing Thread—(the only material we do not produce ourselves)		
1-2-3-4 Color Printing	✓	
Art Department	✓	
Bag Development and Research	✓	

Gilman PAPER CO.

3 Generations of Bag Making Experience

Exclusive Sales Agents for **Kraftpacker** Automatic Open Mouth Bag Filling Machine

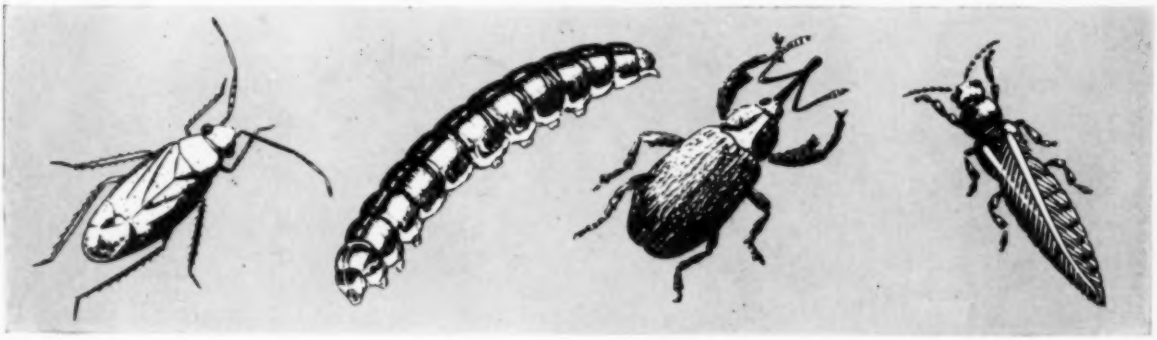
KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary

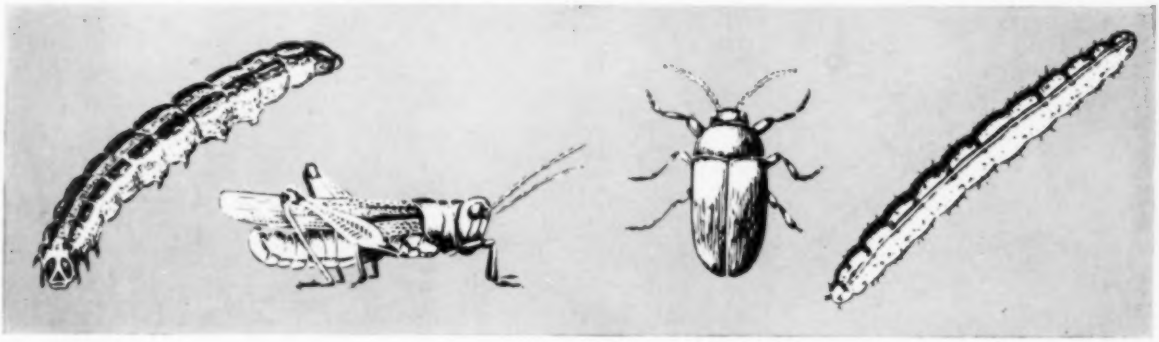
630 Fifth Avenue, New York 20, N. Y. • Daily News Bldg., Chicago 6, Ill.

Plants at St. Marys, Georgia and Gilman, Vermont

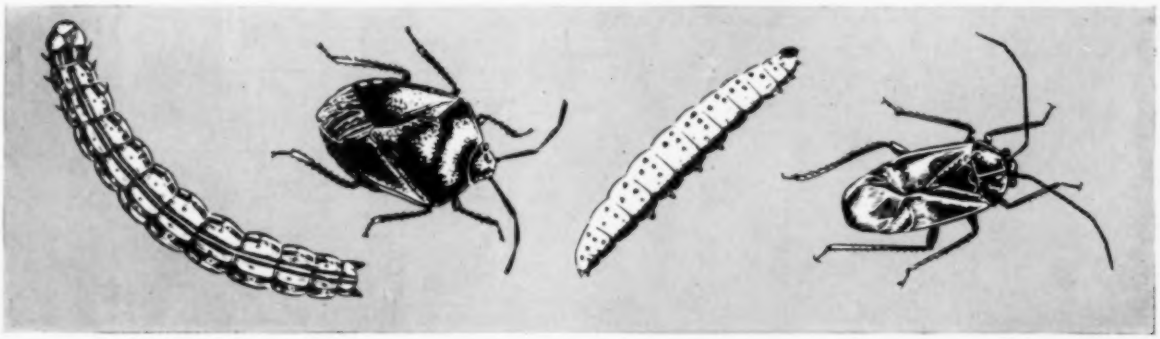
TOXAPHENE IS RECOMMENDED FOR



EFFECTIVE, ECONOMICAL CONTROL



OF MORE THAN 200 INSECT PESTS



HERCULES POWDER COMPANY
INCORPORATED

Agricultural Chemicals Division, Naval Stores Department • 970 Market St., Wilmington 99, Del.